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A
TREATISE
ON
MEDICAL AND PHARMACEUTICAL
CHYMISTRY,
AND THE
MATERIA MEDICA.

A

TREATISE

ON

MEDICAL AND PHARMACEUTICAL

CHYMISTRY,

AND THE

MATERIA MEDICA:

TO WHICH IS ADDED,

AN ENGLISH TRANSLATION OF THE NEW EDITION
OF THE PHARMACOPOEIA OF THE ROYAL
COLLEGE OF PHYSICIANS OF
LONDON, 1788.

IN THREE VOLUMES.

VOL. I.

BY

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THE

PREFACE.

THE following Treatiſe on Medical and Pharmaceutical Chymiſtry, and the Materia Medica, was originally wrote as part of a courſe of lectures on the theory and practice of phyſic, which was read by the author in the years 1758, 59 and 60, and was planned nearly in the form it now appears; with the intention of giving the ſtudents a general idea of the principles of chymiſtry, and its operations employed in the preparation of medicines; and of making them acquainted with the nature, virtues, and doſes of the principal medicines made uſe of in the practice of phyſic; and particularly of both the ſimple and the compound ones mentioned in the London Pharmacopœia.

This courſe of lectures was interrupted

in November 1760, by the author's being appointed one of the phyſicians to the army, then ſerving in Germany; and the manuſcript lay from that time in his ſtudy, without his having any intention of publiſhing it, till the following accident led him to reviſe, correct, and make many additions to it.

In the year 1785, he having been elected at Michaelmas, Senior Cenſor of the College of Phyſicians, and having accidentally mentioned to Sir George Baker, the Preſident, that it would be right to reviſe the Pharmacopœia, and publiſh a new edition of it, Sir George, at the next meeting of the Fellows, deſired him to make a motion for that purpoſe, which he accordingly did; and it was agreed to, that a Committee, conſiſting of the officers of the College, for the time being, and ſuch others of the fellows as choſe it, ſhould meet every Tueſday to reviſe and correct the Pharmacopœia, and to report to the College, from time to time, what progreſs they had made.

The author having in this manner been the perſon pitched upon by the

Preſident, to make the propoſal, at a time when he was Senior Cenſor, thought himſelf particularly obligated to give every aſſiſtance in his power in forwarding the work, which led him to look into what he had formerly wrote on this ſubject, and into the late publications on chymiſtry and the materia medica; and to add to his manuſcript whatever he met with, which appeared to be new, curious, or uſeful; in order that he might be more maſter of the ſubjects which were to come before the Committee, and be better able to give them his aſſiſtance in forming the new Pharmacopœia.

The Committee, after going over, correcting, and adding to the Pharmacopœia whatever new had been propoſed, which they thought deſerved conſideration, came to the reſolution of reviſing it a ſecond time, after a ſpecimen or rough draught ſhould be printed, and a copy ſent to every member of the College, that they might conſider it at their leiſure, and be able to give their opinions of the corrections and additions which had been made, and to propoſe any thing new which they thought had been omitted.

The author, after reviſing the ſpecimen, and ſending to the Committee when they again met, the obſervations he had made in peruſing it, being out of office, did not attend the meetings of the Committee ſo frequently as before; and began to look over his own work, with the additions he had made to it. Judging that it might be uſeful to the younger part of the profeſſion, he came to the reſolution of offering it to the public; and for that purpoſe, ſet about reviſing, correcting, and adding to it what farther obſervations occurred to him, relative either to the nature of the ſubſtances treated of, or to their uſes in the practice of phyſic.

The plan which he has followed is this: after mentioning in a very curſory manner elective attraction, ſolution, and the other principal operations employed for the preparation of medicines, he has treated under diſtinct heads, ſuch articles of the materia medica as could be reduced into claſſes, from ſome known properties which diſtinguiſh them from all other bodies; and theſe he has arranged in as regular a chymical order as the nature of the ſubjects would admit.

After treating of theſe, he has conſidered the entire animal and vegetable ſubſtances, which one may look upon, in ſome meaſure, as compound bodies made up of ſalts, oil, earth, and water, and which cannot be divided into diſtinct claſſes, as thoſe already treated of. Moſt writers on the materia medica have, indeed, divided them into claſſes, according to their ſuppoſed virtues ;—of aromatic, diaphoretic, diuretic, emetic, purgative, ſpaſmodic, &c.; but ſo many objections have been raiſed to every arrangement of this ſort, that he thought it better to follow the example of Dr. Lewis, and to arrange them in an alphabetical order, according to the Latin names, which have been long in uſe; and in order to diſtinguiſh them the more particularly, he has added both the names given them by Linnæus, and the Engliſh ones by which they are beſt known. In treating of this part of the Materia Medica he has endeavoured to point out the beſt menſtrua for extracting their active parts; and, as he has not made many experiments of this kind himſelf, he has uſed thoſe of Geoffroy, Alſton, Neumann, Cartheuſer, Macbride, and others, and particularly thoſe of Cartheuſer, who ſeems to have made the greateſt number of trials to aſcertain theſe facts, of any writer on the ſubject. A great deal is ſtill wanted to be done; and it is to be wiſhed that a number of accurate experiments of this kind were made every year, and that a faithful regiſter was kept of them; for by theſe means, we ſhould, in a ſhort time, come at the knowledge of the beſt methods of making the different tinctures, infuſions, extracts, and decoctions.

In the chymical part of this work, he has carefully avoided entering into the ſubtile philoſophy of chymiſtry, or treating of principles which are ſuppoſed, but have not as yet been demonſtrated to exiſt; and he has generally called ſubſtances by the names by which they have been known for many years; and mentioned, likewiſe, ſuch of thoſe which have been lately adopted, that had come to his knowledge. He has taken no notice of the new French Nomenclature, publiſhed laſt year (1787), as he had not ſeen it before this work was printed. It is compoſed by thoſe four able and ingenious chymiſts Meſſrs. MORVEAU, LAVOISIER, BARTHOLET, and FOURCROY, who have adopted principles intirely new, changed the names of almoſt every ſubſtance which is an object of chymiſtry, and arranged theſe ſubſtances in a particular order, accommodated to their new ſyſtem.

What has been thrown out in this new methodical Nomenclature, ſeems to promiſe to add great improvements to chymiſtry, and ſhould be carefully attended to by all thoſe who labour towards bring-ing this art to perfection, and eſtabliſhing a juſt theory of it as a ſcience; but it ought not to be adopted into medicine till the principles laid down be fully eſtabliſhed, by repeated experiments, made by able chymiſts, in different countries; nor till the new names given to chymical preparations have become familiar to the public ear; for were phyſicians to change the names of medicines upon evey new theory being ſtarted by ingenious men, before it was confirmed by certain experiments, frequently repeated, we ſhould have a new Nomenclature every ſecond or third year; and the names of medicines would be ſo confounded as to give riſe to many dangerous miſtakes. We ought to be the more ſcrupulous in making ſuch changes of names, as alterations in theory, and ſpeculations on the firſt principles of things, do not alter their nature or properties; for theſe remain the ſame, whether the principles of which they are compoſed be found to be thoſe ſuppoſed by former, or by more modern chymiſts. Water will ſtill quench thirſt, dilute the blood, paſs off by the fine excretory veſſels, diſſolve gummous, mucilaginous, and ſaccharine ſubſtances, and boil meat, whether it be found to be a pure elementary body, as believed for ages paſt, or be produced by vital air and inflammable gas, as alledged lately by ſome of the French academicians.—Flame will ſtill produce the ſame effects as ever, whether the principle which feeds it be what was called phlogiſton, or be vital air, as affirmed by more modern chymiſts.—Salts of all kinds will be the ſame, and produce the ſame effects on the human body, whether the original matter or principle which conſtitutes a ſalt, and has never as yet been demonſtrated by any chymiſt, be what Dr. Vogel calls a ſaline principle, or what the authors of the new French Nomenclature call an oxygenous one.—Sulphur will produce the ſame effects, and be uſed for the ſame purpoſes, whether it be a compound body, made, as was formerly ſuppoſed, of the vitriolic acid and phlogiſton, or whether it be what the modern French chymiſts alledge, the acidifiable baſis of the vitriolic acid, united with the oxygenous principle, or acid ſaline principle of former chymiſts. And the ſame will hold good with reſpect to the reſt of the ſubſtances taken notice of by the above-mentioned able chymiſts, in their new Nomenclature.

As the following Treatiſe was originally intended to ſerve as a kind of commentary on the London Pharmacopoeia, and, as it is often referred to, the Author has annexed to the third volume, an Engliſh tranſlation of the new edition of that work, juſt publiſhed; and as the preparations are often quoted by their old names, he has added thoſe, as well as the new, that the reader might not miſtake the formulæ meant in the references.

Since the firſt volume of this work was printed, the Author, in peruſing the ſecond part of vol. 77 of the Philoſophical Tranſactions for the year 1787, finds that, in articles 28 and 29, there are two accounts of the production of borax, different from any of thoſe which he has mentioned in treating of this ſubſtance; for by thoſe it appears that it is a native ſalt found in ſeveral places among the mountains, in the kingdom of Thibet, in the Eaſt Indies, where the ground is ſo highly impregnated with it, that after falls of rain and of ſnow it forms white flakes upon the ſurface, in the ſame manner as the nitre or ſaltpetre does in Indoſtan; and it concretes into cakes in the pools of water in the neighbourhood.

P. S. People of the profeſſion are apt, in their common diſcourſe, indiſcriminately to make uſe of the Latin and Engliſh names of medicines; and the Author, in drawing out the original ſketch of the following work, at a time when he had no intention of offering it to the public, fell inſenſibly into this inaccuracy, and half of the work was printed before he perceived it; the reader will, therefore, be kind enough to excuſe it, if he ſometimes meets with a Latin, and ſometimes with an Engliſh name at the head of the ſections which treat of the different articles.

Argyll-Street,
March 20*th*, 1788.

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Directions for the Bookbinder.

Dr. Morveau's Synoptical Table of Menſtrua and Solvends to be placed between pages 14 and 15, facing page 14.

ERRATA CORRIGENDA.

Page 109, line 1, After *one* add *ſcruple.*
153,—— 2, For *gravelliſh*, read *gravelly.*
346,—— 8, After *precipitated*, add *by an alkali.*
394,——19, For *cryſtals of tartar*, read *tartariſed tartar.*

INTRODUCTION.

OF
CHYMICAL AND PHARMACEUTICAL OPERATIONS.

Of Elective Attraction.

ALL the operations of pharmacy depend either on the combination of different bodies; or on the ſeparation of the different parts of the ſame body; and of courſe are intimately connected with chymiſtry.

Bodies, indeed, may be mechanically combined; but the intimate union, or chymical combination of two different bodies ſo as to form a third, different from either of the two, is only to be effected by that power called attraction, by which the component particles of any body move towards thoſe of another, and unite intimately when brought within a certain diſtance of each other, which is called the ſphere of their attractions.

In order that the particles may be allowed to come within the ſphere of each other's attraction, the bodies muſt be rendered fluid, either by being diſſolved in a menſtruum, or rendered fluid by the force of fire; for while they remain in a ſolid form, their component particles adhere ſo powerfully to each other, that the power of attraction of the particles of other bodies is not ſufficient to ſeparate them and unite themſelves with them.

The ſeparation of the different parts of the ſame body is effected either by the force of fire, or by attraction.

The force of fire ſeparates certain parts of ſome bodies by raiſing them into a vapour, while the more fixt parts remain behind: thus, when we diſtil fragrant herbs and flowers with water, the fine eſſential oil and water come over into the receiver, while the more fixt gummous, reſinous and earthy parts remain behind in the ſtill. The force of fire ſeparates the parts of ſome mixt bodies, by altering the form of ſome of them, while others remain entire: thus ſilver is frequently ſeparated from lead-ore, by throwing the ore into a melting furnace, and applying a certain degree of heat, which converts the lead into a calx or ſcoria, and only melts the ſilver.

The component parts of mixed bodies are ſeparated, as well as combined by elective attractions. Thus camphor is ſeparated from ardent ſpirits by the addition of water, and ſilver from the acid of nitre by the addition of an alkaline ſalt.

This power of attraction takes place more or leſs betwixt moſt bodies, but it acts with greater force between ſome than between others; thus water preſently diſſolves ſalt of tartar, but has no effect on balſam of Tolu; and vinegar attracts greedily any alkaline ſalt thrown into it, but does not make the leaſt impreſſion upon gold.

If two bodies are united in a fluid ſtate, and a third be added, which ſeparates them, by attracting one of them more powerfully than the one to which it was before united, this is called ſimple *elective attraction*; as for example, if ſilver be diſſolved in the acid of nitre, and an alkaline ſalt is added, the alkaline ſalt will be united to the acid, and the ſilver will be precipitated to the bottom of the veſſel.

But if two bodies, each compounded of two or more ſubſtances, be mixed in a fluid ſtate, and the different parts of the one have mutually a greater attraction to the different parts of the other, than to thoſe they were originally combined with, this is called *double elective attraction*. Thus, if corroſive ſublimate be thrown into a ſolution of ſilver in aqua fortis, the ſpirit of ſalt will attract the ſilver more powerfully than the acid of nitre; and the acid of nitre will attract the quickſilver more powerfully than the ſilver; and thus two new compound bodies will be formed.

From this account of elective attractions, we ſee how ſome parts of bodies are decompoſed or ſeparated, and how other new bodies are formed; and from it too we may underſtand, why we in general cannot procure the component parts of bodies pure; as, in order to ſeparate them, we are obliged to employ other ſubſtances, which unite with them, and form new combinations.

As the ſucceſs of moſt proceſſes in chymiſtry, and of a great many in pharmacy depends on a knowledge of the affinity or attraction of bodies to each other, tables have been contrived to ſhew at one view the degree of affinity between ſome of the principal ſubſtances employed in chymiſtry; which are divided into columns; and at the head of each column is placed ſome principal ſubſtance, and below it others in the orders of their affinities, with the original ſubſtance; ſo that if it be combined with any of thoſe in the lower part of the column, any of thoſe above will decompoſe it, or ſeparate it from the original ſubſtance.

The firſt table of this kind was publiſhed in the Memoirs of the Academy of Sciences, A. D. 1718, by Monſ. Geoffroy the elder, and ſince then many long and elaborate ones have been made out by ingenious chymiſts: as his is the moſt ſimple, I ſhall inſert it here, with ſome few additions which have been made to it by late authors, as it is ſufficient to point out the affinities of ſome of the capital ſubſtances uſed in the preparation of medicines; and I ſhall take no notice of the other more elaborate tables, it not being my intention to enter further into chymiſtry, than is ſubſervient to make us acquainted with the nature of the ſubſtances uſed in medicine, and with the preparation of the different remedies made from them.

Table of Affinities.

Acids.	*Muriatic Acid.*	*Nitrous Acid.*	*Vitriolic Acid.*
Phlogiſton.	Tin.	Iron.	Iron.
Fixt Alkali.	Regulus of Antim.	Copper.	Mercury.
Volatile Alkali, and Magneſia.	Copper.	Lead.	Copper.
Abſorbent Earth.	Silver.	Mercury.	Silver.
Metallic Subſtance.	Mercury.	Silver.	
	———		
	———		
	Gold.		

Abſorbent Earth.	*Fixt Alkali.*	*Volatile Alkali.*	*Met. Subſtances.*
Vitriolic Acid.	Vitriolic Acid.	Vitriolic Acid.	Muriatic Acid.
Nitrous Acid.	Nitrous Acid.	Nitrous Acid.	Vitriolic Acid.
Muriatic Acid.	Muriatic Acid.	Muriatic Acid.	Nitrous Acid.
			Vegetable Acid.

Sulphur.	*Mercury.*	*Lead.*	*Copper.*
Fixt Alkali.	Gold.	Silver.	Mercury.
Iron.	Silver.	Copper.	Lapis Calaminaris.
Copper.	Lead.		
Lead.	Copper.		
Silver.	Zinc.		
Regulus of Antimony.	Regulus of Antim.		
Mercury.			
Gold.			

Silver.	*Iron.*	*Regulus of Antim.*	*Water.*
Lead.	Regulus of Antim.	Iron.	Spirit of Wine.
Copper.	Silver. Copper.	Silver. Copper.	Salt.
	Lead.	Lead.	

Spirit of Wine.	*Fixt Air.*		
Water.	Calcareous Earth deprived of Air or Quicklime.		
Oil.	Fixt Alkali.		
	Magneſia.		
	Volatile Alkali.		

There have been ſeveral objections raiſed to this table of Mr. Geoffroy's, and a number of exceptions have been made to his arrangement; but it is ſufficiently accurate to give us an idea of the doctrine of elective attractions, and to make us underſtand what happens in the performance of many proceſſes uſed for the preparation of medicines.

It ought to be obſerved with regard to this doctrine of attractions, that moſt of the phænomena obſerved in chymiſtry are founded on this affinity or elective attraction, which one ſubſtance has to another; in ſo much, that the celebrated Sir Tobern Bergman affirms that the whole of chymiſtry reſts upon it, as upon a ſolid foundation, at leaſt if we wiſh to have the ſcience in a rational form; and that each circumſtance of its operations ſhould be clearly and juſtly explained; and he deſires thoſe who doubt of this to conſider the obſervations he has made in his Diſſertation on Elective Attractions, and to bring them to the teſt of experiment.

The only external condition hitherto obſerved, which either weakens or totally inverts the affinities of bodies ſubjected to experiments, is the different intenſity of heat; but this cauſe can only operate in caſes where the ſame temperature renders ſome bodies remarkably volatile in compariſon of others.

Could a complete table of affinities be formed, in which all the varieties and exceptions to the general rules were marked, we ſhould have the whole of this ſcience laid before us at one view; but new experiments and obſervations daily point out to us freſh matter to be added to the tables we now have, and exceptions to many of the rules laid down before; ſo that it muſt be a long ſeries of years before any table approaching to perfection can be formed.

Of Solution.

HAVING thus mentioned ſuperficially the doctrine of elective attraction, I ſhall next conſider more particularly *ſolution*, as it is one of the great inſtruments made uſe of in pharmacy, and is employed more or leſs in every operation of chymiſtry; both the combination and ſeparation of bodies in a great meaſure depending upon it; for two bodies cannot be intimately (chymically) united ſo as to form a third, till they be both rendered fluid, and their minute particles are allowed to come within the ſphere of each other's attraction; nor can any ſeparation of parts take place in mixed bodies till they are reduced to a fluid ſtate.

By a true and perfect ſolution of a body is meant, an equal diſperſion and ſuſpenſion of its ſmall particles in a fluid, ſo that an equal quantity of them are contained in every equal quantity of the fluid or menſtruum, and are kept ſuſpended by the mutual attraction of the particles of the body and of the menſtruum.

In this operation of ſolution the principal things to be conſidered are,

1. The body to be diſſolved, which is called the ſolvend.

2. The fluid which is to make the ſolution, which is called the menſtruum or ſolvent.

The menſtruum, in common, is capable of diſſolving only a certain quantity of a body, after which it will diſſolve no more of it in the ſame degree of heat, and then the menſtruum is ſaid to be ſaturated; but if the heat be increaſed, the power of ſolution in the menſtruum is increaſed in many inſtances, and it is then capable of diſſolving a greater quantity of the ſolvend than when it was cold.

On this quality of a fluid or menſtruum being capable of diſſolving only a certain quantity of any body, and of its power of ſolution being increaſed by heat, depends cryſtalliſation, or that property which ſaline bodies have of aſſuming certain regular forms when they concrete in a leſs quantity of fluid than is capable of keeping them diſſolved, as we ſee every day happen when ſalts are diſſolved in a large quantity of water, and the water is evaporated to a certain length, and ſet by in a cool place to allow them to ſhoot into cryſtals.

No body or ſubſtance can be diſſolved in a menſtruum without uniting with it, and forming a third different from either; and as each different body united with the ſame menſtruum, and each menſtruum united with the ſame body, forms a new ſubſtance, the variety of bodies thus produced muſt be infinite. However, in order to ſhew at one view the products of moſt of the combinations, which are the common ſubjects of chymical operations, Monſ. Morveau, in his Treatiſe on Chymiſtry, publiſhed at Dijon, A. D. 1777, has given us a table, formed on the plan of the common arithmetical multiplication ones, in which he has placed the names of twenty of the principal menſtrua in one horizontal line at the top, and the names of thirty of the principal ſubſtances employed in chymiſtry, one below another in the margin, in a line deſcending perpendicular from the beginning of the horizontal line juſt mentioned. Then he has drawn horizontal lines parallel to the firſt, above and below the name of each ſubſtance marked in the margin;

and afterwards drawn perpendicular lines parallel to each other, and deſcending between the names of the menſtrua, ſo as to inſerſect the horizontal lines, and form little ſquares; in each of which he has placed the name of the body formed, by the union of the menſtruum marked at the top between the two perpendicular lines on each ſide, and of the ſubſtance marked in the margin between the two horizontal lines above and below it.

In this table thoſe ſquares are left blank, where the product, of the mixture of the two ſubſtances which ſhould fill them, is not known, and a ſtar is added to ſome blank ſquares to ſhew that experiments had been made, without effect, to determine it.

And where a ſtar is added to a ſquare which has the name of the product in it, it ſhews that the order of affinity is ſubjected to certain circumſtances; thus the ſtar put in the ſquare where the marine acid and ſilver meet, denotes that ſilver is not ſoluble by that acid in its metallic form; though it is, after it has been reduced to the ſtate of a calx by precipitation.

As this table ſeems to be both uſeful and inſtructive, I have here ſubjoined it.

Of

Mr. Morveau's Synoptical Table of Chymical *Solvents* or *Menſtrua*, and of the moſt ſimple *Solvends* or *Baſes*, and of the *Products* of their Union.

PART FIRST.

		Simple Elements.			ACIDS.						
					Taken from the Mineral Kingdom.						From Veg. K.
	BASES.	I. Fire.	II. Air.	III. Water.	IV. Vitriolic Acid.	V. Nitrous Acid.	VI. Marine Acid.	VII. Aq. Reg. Acid.	VIII. Arſenic. Acid.	IX. Sedative Salt.	X. Vinegar.
Elements.	Fire.	Aggregation.	Phlogiſtic Air.	Fluid Vapour.	Sulphur.	Red Vapours.				Glaſs.	
	Air.	Combuſtion.	Aggregation.	Water with fixed Air.							
	Water.	Fluid Vapour.	Penetration Vapour.	Aggregation.	Solution with Heat.	Solution Blue.	Solution.	Solution.	Solution.	Solution.	Solution.
Earths.	Crystalline.	Glaſs.	*	*	* Liquor of ſoluble Flint.	* Liquor of ſoluble Flint.	* Liquor of ſoluble Flint.	*	*	* Soluble Precipitate.	* Soluble Precipitate.
	Argillaceous.	Glaſs.	*	Solution.	Alum.	Aluminous Nitre	Aluminous marine Salt.		* Aluminous Arſenic.	* Soluble Precipitate.	* Aluminous Salt of Vinegar.
	Calcarious.	Lime, Glaſs.	Slackt Lime inſoluble.	Lime Water.	Selenite Gypſum.	Calcarious Nitre.	Calcarious marine Salt.		Calcarious Arſenic.	Calcarious Sedative Salt.	Salt of Chalk.
	Magnesia.	Calcined Magneſia, Glaſs.	Slackt Calx of Magneſia.	*	Epſom Salt.	Nitrated Magneſia.	Incryſtalliſable Solution.		*	Sedative Salt of Magneſia.	Incryſtalliſable Salt.
Alkali.	Vegetable.	Cauſtic Alkali.	Cryſtallized veget. Alkali.	Solution.	Tartarus Vitriolatus.	Nitre.	Sylvius digeſtive Salt.		Liver of Arſenic, Neutral Arſenical Salt.	Vegetable Borax.	Terra foliata Tartari.
	Mineral.	Cauſtic m. Alkali.	Cryſtallized m. Alkali.	Solution.	Glauber Salt.	Cubic Nitre.	Sea Salt.		Liver of Neutral & min. Arſenic.	Borax.	Acetous Mineral Salt.
	Volatile.	Vapour.	Concrete volatile Alkali.	Solution.	Vitriolic Ammoniac.	Ammoniacal Nitre.	Sal Ammoniac.		Am. Liver of Arſenic, ammoniacal Arſenic.	Ammoniac. Borax.	Spirit. Mindereri.
Metals.	Gold.	Fluid Metal.	* Purple Calx.	*	* Soluble Precipitate.	* Soluble Precipitate.	* Soluble Precipitate.	Solution.	*	*	* Soluble Precipitate.
	Platina.	Fluid Metal.	* Calx.	*	* Calcined by Nitre, ſoluble.	* Soluble Precipitate.	*	Solution.	* Soluble Precipitate.	*	* Soluble Precipitate.
	Silver.	Fluid Metal.	* Calx.	*	Vitriol of Silver.	Lunar Cauſtic.	* Luna Cornea.	*	* Red Silver.	* Soluble Precipitate.	* Soluble Precipitate.
	Mercury.	Fluid Metal, Vapour.	* Calx.	*	Vitriol of Mercury, Turpith Min.	Mercurial Nitre, or Nitrous Turpith.	Corroſive Sublimate, Mercurius dulcis.	Solution of Sublim. corroſive.	* Mercuriated Arſenic.	* Sal Sedativus Mercurial.	* Acetous Mercurial Salt.
	Copper.	Fluid Metal, Glaſs.	Green Calx.	*	Blue Vitriol.	Nitrated Copper.	Muriated Copper.	Solution of bluiſh green.	Coppery Arſenic.	Solution.	Cryſtals of Venus.
	Lead.	Fluid Metal, Glaſs.	White Calx, Minium.	*	Vitriol of Lead.	Nitrated Lead.	Plumbum Corneum.	Solution of Plumbum Corneum.	* Calcination in the dry way.	* Soluble Precipitate.	Ceruſs, Saccharum Saturni.
	Tin.	Fluid Metal, Enamel.	White Calx.	*	Vitriol of Tin.	White Calx.	Butter of Tin.	Solution, Cryſtals.	* Calcination in the dry way.	Solution.	Solution.
	Iron.	Fluid Metal, Glaſs.	Ruſt, Spathic Ore.	Ethiops.	Green Vitriol, or Vitriol of Iron.	Solution.	Solution.	Solution.	Martial Arſenic.	Sal Sedativus martial.	Acetous martial Salt.
Demimetals.	Antimony.	Fluid Metal, Glaſs.	Calx, Flowers.	*	Antimoniated Vitriol.	Solution, White Calx.	Butter of Antimony.	Solution.	* Soluble Precipitate.	* Soluble Precipitate.	* Soluble Precipitate.
	Bismuth.	Fluid Metal, Glaſs.	Calx, Flowers.	*	Vitriol of Biſmuth.	Nitre of Biſmuth.	Butter of Biſmuth.	Solution.	* Soluble Precipitate.	*	*
	Zinc.	Fluid Metal, Glaſs.	Calx, Flowers.	*	White Vitriol, or Vitriol of Zinc.	Solution.	Butter of Zinc.	Solution.	Arſenical Zinc.	Sedative Zinc.	Acetous Salt of Zinc.
	Arsenic.	Fluid Metal, Vapour.	White Calx cryſtalline.	Solution.	Vitriolated Arſenic.	Mixt Acid.	Butter of Arſenic.		Mixture.	Fixed Arſenic.	Liquid Phoſphorus.
	Cobalt.	Fluid Metal, Smalt.	Calx, Safre.	*	Vitriol of Cobalt.	Nitre of Cobalt.	Sympathetic Ink.	Sympathetic Ink.	*	* Soluble Precipitate.	* Soluble Precipitate.
	Nickel.	Fluid Metal, Glaſs.	Calx.	*	Vitriol of Nickel.	Nitrated Nickel.	Solution.		Arſenical Nickel.	* Soluble Precipitate.	Acetous Salt of Nickel.
Oily Subſtances.	Bitumen.	Coal.	Aſhes.	*							*
	Essential Oils.	Coal.	Aſhes.	* Emulſion.	Artificial Reſin.	Spontaneous Inflammation.				Imperfect Soap.	Solution.
	Unctuous Oils.	Coal.	Aſhes.	*	Solution, Acid Soap.					Imperfect Soap.	* Acid Soap.
	Resin.	Coal.	Aſhes.	*						*	*
	Gum.	Coal.	Aſhes.	Solution.						Solution.	Solution.
	Spirit of Wine.	Vapour.	Aſhes.	Solution, Brandy.	Dulcified Spirit of Vitriol, Æther.	Dulc. Spirit of Nitre and Æther.	Dulc. Spirit of Salt, and Æther.			Solution, Green Flame.	Acetous Æther.

Of the Operations, Veſſels, Weights, and Meaſures employed in Pharmacy.

THE operations employed at preſent in the preparation of medicines are confined to a few.

1. The infuſing certain ſubſtances in cold or in hot water or in wine, to extract their ſaline or light gummy parts, together with ſome of their fine volatile principles, which are miſcible with water.

2. The boiling them in water to extract the ſame principles, together with others that are more fixt, or which are capable of being diſſolved by heat and afterwards of being kept ſuſpended by the gummous and mucilaginous parts, which have been diſſolved in the water; thus a certain proportion of reſin is found to be ſuſpended in decoctions of the bark, of opium, and of other drugs.

3. The evaporating watery infuſions and decoctions, and the expreſſed juices of many vegetables, to obtain their fixt parts, which have been diſſolved in a watery menſtruum. In this manner jellies, robs, and extracts are prepared.

4. The infuſing or digeſting certain vegetable ſubſtances in pure vinous ſpirit, to extract their fine eſſential oils, and their reſinous parts; or in ſpirit mixed with water, called proof ſpirit, to extract along with theſe principles, likewiſe ſome of their gummous parts.

5. The evaporating of ſuch tinctures to obtain their reſinous and more fixt parts; in which way reſinous extracts are got from bark, from jalap, from opium and from other ſubſtances.

6. The diſtilling fragrant vegetable ſubſtances with water, in order to procure their fine volatile principles, which come over with the water into the veſſels placed to receive it. In this manner the ſimple diſtilled waters (as they are called) which have the flavour and taſte of the ſubſtances from which they were diſtilled, are prepared; and the fine eſſential oils of the plants which have been diſtilled, are found either floating on the top of the water, or ſunk to the bottom of it, according as they are ſpecifically lighter or heavier than water.

7. The diſtilling the ſame ſubſtances in

vinous ſpirit to obtain the ſame fragrant volatile parts, intimately united with the ſpirit; in which manner are made the ſpirituous liquors, improperly called ſpirituous waters.

8. The diſtilling of vegetable or animal ſubſtances in retorts, without water; in order to make riſe and bring over by the force of fire, their watery phlegm, an acid, or volatile alkaline ſalt, according to what nature the ſubſtances are of, and an empyreumatic oil, into the receiver; and to get the more fixt earthy and oily parts which are left behind in the retort.

Formerly chymiſts imagined that they could obtain in this manner the principles of which bodies were compoſed, ſeparate from each other; and when they performed this proceſs they were ſaid to have made a chymical analyſis of the body which was the ſubject of their operation; but experience has ſhewn that the force of fire makes new combinations of the principles of which the bodies were compoſed; and that the products of ſuch diſtillations are very different from any thing that naturally exiſted in the body analyſed.

By ſuch diſtillations, however, many ſubſtances have been prepared, which have been uſed in medicine. An acid has been got from fir and other reſinous woods, which has been frequently given as a medicine. The empyreumatic oil, got from hartſhorn, when purified has been called oleum animale, and recommended for the cure of epilepſies and other diſorders; and a volatile alkaline ſalt has been got from muſtard ſeed and many other vegetable ſubſtances, and from the horns, bones, and other parts of animals.

9. The burning vegetable ſubſtances in an open veſſel to obtain a fixt alkaline ſalt. The fixt vegetable alkali is got from the aſhes of wormwood, fern, woods of different kinds, and of moſt other vegetables. The foſſil alkali, as it is called, from burning the kali and other marine plants.

10. The burning or calcining the bones of animals, or the ſhells of fiſhes to procure their earthy parts; in which manner the cal-

cined hartſhorn, the powder of crabs claws, and of oyſter ſhells are procured.

11. The raiſing a certain inteſtine motion in water which contains more or leſs of a ſaccharine juice, by the application of a certain degree of heat. This proceſs has been called fermentation, and has been divided into three different kinds, the vinous, the acetous, and the putrid; though in reality the two latter are only different ſtages of the ſame proceſs; for vegetables, which are the proper ſubjects of fermentation, when ſet to ferment firſt, produce a vinous liquor, a wine, a beer, or a cyder, or whatever it may be; from which an ardent ſpirit may be drawn off by diſtillation. If the fermentation be allowed to go on, this vinous liquor is changed into a vinegar which contains an acid, which may be concentrated by evaporation. And if the fermentation is allowed to go on ſtill further, the vinegar becomes a putrid liquor, from which a volatile alkaline ſalt may be ſublimed.

Hence we ſee that the vinous, the acetous, and the putrid fermentations are only different ſtages of the ſame proceſs. In objection, however, to this doctrine, it has been alledged that certain bodies at once become acid and others putrid, without having gone through the previous ſtages of fermentation; but upon an accurate examination it appears that theſe bodies have undergone proceſſes analogous to thoſe which they ſeem to have paſſed over. Thus animal ſubſtances which become at once putrid, were originally formed from vegetables, which if left to themſelves would have undergone the regular progreſſive ſtages of fermentation; but the proceſs which they undergo in the body of the animal, of which they were a part, ſeems to make new combinations, and to produce effects ſimilar to thoſe produced by the two firſt ſtages of fermentation, and hence when ſet to ferment they immediately putrefy; and the progreſs of the changes which vegetable food undergoes in the animal body may be eaſily traced. In the ſtomach a fermentation ſimilar to the vinous ſeems to commence, which is ſoon checked by the mixture of animal juices. When the chyle is taken up into the blood, and diſcharged out of the body before the animal proceſs is completed, as it is in the form of milk, we find that it firſt turns ſour before it becomes putrid. But when the animal proceſs has been fully completed, which it is before the chyle becomes part of the animal, it then goes immediately into a ſtate of putrefaction.

12. The mixing acid and alkaline ſalts in a fluid ſtate, to form the true neutral ſalts; which may be ſeparated from the water, either by evaporating, with a ſlow heat, ſuch a quantity of the water as to allow the ſalts to ſhoot into cryſtals, when ſet in a cool place; or by continuing the evaporation till the ſalts become dry.

13. The diſſolving certain metallic ſubſtances or certain earths in acid liquors, for obtaining metallic and earthy ſalts, which may be got in a ſolid form in the ſame manner as the neutral ſalts.

14. The evaporating the purified expreſſed juices of certain vegetable ſubſtances to the conſiſtence of a cream, and then ſetting them by, for months, in a cool place,

to allow the eſſential acid ſalts to concrete into cryſtals.

15. The diſtilling, in proper veſſels, vitriol or other ſubſtances which contain the vitriolic acid, in order to get it ſeparate from them; and the burning of ſulphur, mixed with a ſmall portion of nitre, under particular veſſels ſo contrived and ſo placed as to collect the ſame ſort of acid.

16. The diſtilling nitre or ſea ſalt mixt with a certain portion of the vitriolic acid, in order to obtain pure the acids of nitre or of ſea ſalt.

17. The ſubliming certain ſubſtances that become volatile, by the application of heat, into proper veſſels; and either to unite two of them together for the formation of a third, as is done in the preparation of the corroſive ſublimate mercury, when the marine acid is united to the quickſilver; or to ſeparate the volatile parts of any ſubſtance from the fixt, as is done in the ſublimation of volatile alkaline ſalts and of the flowers of Benjamin.

18. The melting by the force of fire ſuch ſubſtances as become fluid by the ap-

plication of heat, ſo that they may be ſeparated from, or united to other bodies. Thus by particular management and the addition of certain ſubſtances metals are ſeparated from their ores. And roſin and bees-wax are intimately united together; or they are diſſolved in fluid oils for the preparation of plaſters, ointments, liniments, &c. And ſulphur is united to quickſilver for the making of an æthiops mineral, or a factitious cinnabar.

19. The applying of heat; either to deprive metallic bodies of their phlogiſton and reduce them to the ſtate of a calx; or to ſeparate volatile ſubſtances, together with part of their own phlogiſton, from mixt metallic bodies; or when certain metals are mixt, to melt only one of them while we reduce the other to a calx or ſcoriæ. Thus mercury is reduced to a red calx by the mere continued application of heat. Crude antimony is deprived of its ſulphur and part of its phlogiſton by being calcined with hartſhorn, and it is reduced to an inert calx by being dephlagrated with three times its own weight of nitre. And ſilver

is ſeparated from lead by being expoſed to a great heat which only melts the ſilver, but reduces the lead to ſcoriæ.

20. The applying of heat to vitrify certain metallic ſubſtances, as is practiſed in the preparing of the glaſs of antimony.

21. The ſtraining liquors through flannel or linen, or filtering them through paper, to ſeparate thick or groſs parts which are not diſſolved by the liquor.

22. The ſimply mixing liquors to form a compound, or the mixing them with the addition of a gum or mucilage to keep the one ſuſpended in the other, or with the addition of an alkaline ſalt, or of a ſoap or other body to make them incorporate.

23. The reducing certain ſubſtances to a fine powder, and the mixing them together by triturating them in a mortar or other veſſel.

24. The mixing of powders together, and by the addition of ſyrup or mucilage forming them into boluſes, pills, electuaries; and the mixing of various other ſubſtances in different forms for medical uſes.

Having mentioned the principal operations which are made uſe of in pharmacy, I ſhall next make a few obſervations on the veſſels, weights, and meaſures, employed in that art.

Hitherto copper and bell-metal have been uſed for making the large mortars of the ſhops, and for making the kettles and pans for preparing decoctions, ſyrups, and other things which want boiling; but as many diſagreeable accidents have happened, from victuals having been dreſſed in copper kettles and pans, where the tinning has been worn off; and from pickles and other things being prepared in copper or braſs veſſels; and many may have happened, which have paſſed unobſerved, from people ſwallowing teſtaceous and other powders which have been impregnated with copper from being rubbed in bell-metal or braſs mortars, the uſe of copper for making veſſels for the apothecaries ſhops ought to be laid aſide, and iron, which is a wholeſome metal, be ſubſtituted in its place.

Mortars made of iron, particularly of caſt iron, anſwer every purpoſe of the bell-metal and braſs mortars; and kettles and pans made of caſt-iron, or of other iron tinned, ſuch as are now uſed in moſt gentlemen's kitchens in London, are infinitely preferable to thoſe made of copper, on every account, at the ſame time that they are cheaper, and may be eaſily kept clean and prevented from ruſting.

The ſmaller mortars made (by Mr. Wedgewood and other manufacturers in England) of baked earth or clay, which are hard, ſmooth, and ſtrong, and are not acted upon by acid, alkaline, or oily ſubſtances, are very proper to be uſed for the preparation of medicines; as likewiſe are ſmall glaſs mortars for rubbing ſmall quantities of mercurial or antimonial preparations in. And mortars made of marble may be employed for the preparation of emulſions and of other mild things.

Funnels ought to be made of tinned iron, or of glaſs, or of the ſame ſort of baked earth or clay as the mortars, or of ſilver, or of block tin.

Veſſels uſed for preparing infuſions, or for evaporating liquors, or for putting decoctions,

coctions, or other liquors into, to cool, ought to be made either of porcelain, or of ſtone ware, or of baked clay or of earth, ſuch as the mortars are made of, or of glaſs; as ſuch veſſels are not acted upon either by acid or by alkaline liquors.

For the ſame reaſons meaſures of all ſorts, from the dram to the quart, ought to be made of tinned iron or of ſtone ware, or of the baked earth or clay, or of glaſs; ſilver might be employed for the ſmaller meaſures of drams and ounces, and if taken care of, would in the end prove cheaper than the others; if other metallic veſſels are uſed, the metal ought to be of ſuch a ſort as not to be affected by acid or alkaline or other liquors; and they ought at all times to be kept extremely clean.

In diſtilling, in melting, and in calcining different bodies, no veſſels ought to be employed which may be acted upon by, and give a noxious quality to the ſubſtances to be prepared.

In diſtilling, care ought to be taken, to make the vapours which ariſe condenſe properly in the veſſels ſet to receive them, when they have aſſumed the form of a liquor; which is to be effected, 1. By regulating the fire, and never raiſing the degree of heat beyond what is neceſſary: 2. And by making the vapours paſs through ſuch a cool medium as will condenſe them into a liquid.

1. The degree of heat is regulated by the figure of the furnace in which the fire is placed, and by the quantity of wood or of coal that is uſed. Where a great degree of heat is wanted, the veſſels are put in an open fire, placed in a reverberatory furnace. Where a leſs degree of heat is ſufficient, they are put into ſand contained in an iron pot, below which the fire is lighted in a common furnace. Where ſtill a ſmaller degree is required, the veſſel is put into a pot with ſand, and a lamp, in place of a coal fire, ſet below it. At other times the retort or veſſel with the liquor to be diſtilled, is put into a veſſel full of water or other liquor ſet over a fire, ſo that it cannot be heated beyond a certain degree.

2. The condenſation of vapours ariſing from ſubſtances, ſubjected to diſtillation, is

effected, as I before obſerved, by making the vapour paſs through ſuch a cool medium as will condenſe it into a liquor, before it reaches the bottom of the veſſels ſet to receive it.

In diſtilling medicated waters or ſpirits, the herbs or other vegetable ſubſtances, and the water or the ſpirit are put into a ſtill placed in a proper furnace, on which is fixed a large head with a long crane-necked or curved tube coming from the top of it, which after deſcending and going off a little to one ſide, enters into the upper end of a long ſpiral pipe, called a worm, which is fixed in a large caſk called the worm-tub, or refrigeratory, with its two ends piercing the caſk; and to its lower end is fixed a proper veſſel for receiving the diſtilled liquor. The worm-tub, which has a cock at the lower part of it, for letting out water occaſionally, is filled with cold water before the diſtillation begins, and is renewed in the courſe of the diſtillation if it begins to heat, by drawing it off by means of the cock, and pouring freſh cold water into the worm-tub. After every thing is fitted, the fire is lighted, and the diſtillation is continued ſo long as the water or ſpirit comes over ſufficiently impregnated with the vegetable ſubſtances put into the ſtill.

If the vegetable ſubject, which is diſtilled, contains fixed parts, which we wiſh to preſerve in form of an extract, the liquor remaining in the ſtill, after being ſtrained through a cloth, or filtered through paper, if thought neceſſary, may be evaporated to the conſiſtence of an extract; and the extract thus prepared will be equally good as if it had been made in the common way, by evaporation in open veſſels.

In the diſtillation of vegetable or animal ſubſtances with water, or with ſpirit, it ought to be obſerved, 1. That there ought always to be put into the ſtill ſuch an additional quantity of water as will prevent the ſolid ſubſtances which are the ſubjects of the diſtillation, from being burnt, as this additional water does not at all weaken the produce; for the moſt volatile parts of the ſubject riſe firſt, and impregnate the liquor which firſt comes over, and the water remains behind in the ſtill. 2. That a gentle fire, ſuch as is juſt capable of keeping the liquor boiling, is preferable to a ſtrong fire, particularly towards the end of the proceſs. 3. That the diſtillation is to be continued ſo long as the liquor comes over fully impregnated with the volatile parts of the vegetable ſubſtances which are the ſubjects of the diſtillation; but is to be put an end to, ſo ſoon as it is perceived to become weak, which is known by taſting from time to time the liquor which comes over.

In diſtilling ſubſtances which require a greater degree of heat to raiſe their volatile parts, than the liquors above-mentioned; or which are of ſuch a nature as to act upon and corrode the veſſels employed in theſe proceſſes juſt mentioned, it is neceſſary to uſe the veſſels made of glaſs, or of earth, which have been called retorts, from their neck being bent to one ſide. Such retorts are employed in pharmacy for diſtilling the mineral, and the vegetable acids, and the preparations made from them; in diſtilling animal and vegetable ſubſtances by themſelves to procure their watery, ſaline, or oily parts; for purifying quickſilver, and preparing the cauſticum antimoniale and the flores Martis; and they may be uſed as ſubliming glaſſes for making mercurial and other preparations.

In diſtilling with retorts, the matter to be diſtilled is put into the retort, which is commonly placed in ſand contained in an iron pot, fixed above a furnace, into which the fire is put; but on ſome particular occaſions where only a ſmall degree of heat, not exceeding that of boiling water, is wanted, the retort is placed in a water bath.

After the retort, containing the matter to be diſtilled, is fixed, the end of it is either put immediately into the mouth of another long necked veſſel called a receiver (from its being placed to receive the diſtilled liquor), and the two veſſels are luted together by means of a proper cement; or it is put firſt into the end of a long glaſs tube called an adopter, which is luted to it, and the other end of the tube is put into the mouth of the receiver, and fixed to it by means of a cement.

The receivers are either made round like a decanter, without any other opening than the mouth; or they are made with a tube coming out from their bottom or from the ſide near it, to which another receiver may be fixed; and when they are thus made they are called tubulated receivers, and are very convenient for performing proceſſes where the matter put into the retort yields products of different kinds, as in the diſtillation of ſpirit with the mineral acids; for the receiver or bottle, fixed to the tube, may be changed as the different products come over, ſo that each of them may be obtained ſeparate. And in diſtilling ſubjects which yield very volatile products, one tubulated retort may be put after another, ſo as to enlarge the ſpace for the condenſation of vapours; and in diſtilling theſe very volatile ſubſtances, it is ſometimes neceſſary to make a ſmall puncture into the lutes between the retort and receiver, to allow ſome of the vapour to eſcape, to prevent its burſting the veſſels.

The uſe of the long intervening tube, called an adopter, which is put often between the retort and the receiver, is to increaſe the diſtance from the retort (that is immediately expoſed to the heat) to the receiver; ſo that the receiver may be in leſs danger of being heated, and that the vapour may be cooled in its paſſage through this tube, and condenſe more readily in the receiver. It is likewiſe of another uſe, which is to give us an opportunity of ſeeing the vapour in its paſſage from the retort to the receiver, ſo that we may know how the diſtillation is going forward, and when it is proper to change the receivers, when the different liquors come over, from materials which yield products of different kinds.

Moſt colleges of phyſicians in Europe formerly directed, that both weights and meaſures ſhould be employed for diſpenſing medicines, ordering ſolid ſubſtances to be prepared by weight, fluid by meaſure; and they gave tables of the weights and meaſures they wiſhed ſhould be uſed, in the beginning of their different diſpenſatories;

ries; but it having been found that the promiſcuous uſe of weights and meaſures gave ſometimes occaſion to miſtakes, the colleges of Edinburgh and of Stockholm have, in the laſt editions of their Pharmacopoeias, rejected entirely the uſe of meaſures, and ordered both fluid and ſolid ſubſtances to be prepared by weight. It is to be wiſhed that all the colleges in Europe would follow their example.

Meaſures made to contain a certain determined weight of water, are certainly very uſeful in pharmacy; but if ſuch are allowed, they ought to be employed only for meaſuring watery liquors, as the ſpecific gravities of other fluids differ ſo much from one another.

In every country all weights and meaſures uſed for the preparation of medicines, ought to be made according to the directions of the college of phyſicians; ſtandards of them ought to be kept in proper places, and all thoſe uſed ought to be ſtampt, to ſhew that they were made according to the ſtandard.

OF

PHARMACEUTICAL CHYMISTRY,

AND THE

MATERIA MEDICA.

Of the Diviſion of Medicines into different Claſſes.

HAVING taken a general view of the operations by which bodies are combined and ſeparated for medical uſes, I ſhall next conſider particularly, the properties and virtues of ſuch ſubſtances as can be ranged in a chymical order, under the heads,

1. Of ſalts, acid, alkaline and neutral.—2. Of earths.—3. Of metals, and metallic preparations.—4. Of ſulphur.—5. Of the products of fermentation.—6. Of oils, foſ-

ſil, animal, and vegetable.—7. Of bitumens; reſins and gum reſins.—8. Of inſpiſſated vegetable juices, gums and mucilages.—9. Of plain and mineral waters. And then I ſhall conſider the different animal and vegetable ſubſtances uſed in medicine, which could not be comprehended under theſe general heads.

CHAP. I.

Of Salts.

A SALT is a ſubſtance ſapid to the taſte, and ſoluble in water.

Moſt chymiſts who treat of the original principles of bodies, ſuppoſe that there is a ſaline principle in nature, to which all ſalts owe their origin; though ſome very great men *(Stahl* and *Becher)* do not allow that any ſuch exiſts; but alledge, that even acids are compounds, made up of water and of earth. Dr. Vogel, one of the ableſt chymiſts of his time, after conſidering well what Dr. Stahl has ſaid on this ſubject, differs from him in opinion, and affirms * that ſuch a principle really exiſts, which, he ſays, when by itſelf, is too ſubtile to be obſerved by our ſenſes; but as ſoon as it is united to water and earth, becomes manifeſt. Dr. Stahl had founded his opinion on his having by repeated ſolutions and diſtillations reduced acid ſalts to mere water and earth; but Dr. Vogel thinks that the ſubtile ſaline principle had eſcaped during the performance of theſe operations, for that no chymiſt as yet had been able to make a ſalt of theſe two principles alone, by any art whatever. This principle he ſuppoſes to exiſt every where in nature, in the atmoſphere, in ſubterraneous caverns, and in other places; and that according to what bodies it unites with, it forms different ſort of ſalts.

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* Dr. Vogel was Profeſſor of Chymiſtry in the Univerſity of Gottingen in Hanover, and publiſhed, about the year 1752, his Inſtitutiones Chemiæ.

Salts are divided into *ſimple* and *compound.*

The ſimple are the *acid* and the *alkaline.*

The acids are commonly reckoned four in number, three mineral and one vegetable; to wit,

1. The *vitriolic.*—2. The *nitrous.*—3. The *muriatic.*—4. And the *vegetable.*

The alkalies have been reckoned three.

1. The *vegetable.*—2. The *foſſil.*—3. And the *volatile.*

But the experience of later chymiſts has ſhewn that there are a great many more *acid ſalts* than was formerly believed; and it is not at all improbable but that there are more alkaline than are hitherto known.

The *compound ſalts* are formed from the combination of either an alkaline ſalt, or a metal, or an earth with an acid, and are many in number.

CHAP. II.

SECT. I.

Of Acids.

ACIDS are diſtinguiſhed from all other ſubſtances by their ſour taſte, by their changing the blue colour of vegetables to a red, and by their forming true neutral ſalts with the three different alkalies.

They generally appear in a liquid form, owing to their being mixt with water, which they attract with great avidity; they contain air, and are ſuppoſed to owe their colour and volatility to a mixture of phlogiſton.

They formerly were reckoned to be only four in number, though later obſervations have ſhewn that there are many; but as the three mineral and a few of the vegetable are the only ones uſed in practice, I ſhall paſs over the others ſlightly, and do little more than name them.

SECT II.

Of the Vitriolic Acid.

THE vitriolic is the ſtrongeſt of all the acids, and is reckoned to belong to the mineral kingdom.

It enters into the compoſition of a number of bodies found native in the bowels of the earth.—In vitriols.—In native true and calcareous Glauber ſalts.—In talc.—In gypſum.—In alum.— In bitumens.—In ſulphur.—In mineral waters, and in many other mineral bodies.

It has not hitherto been diſcovered to exiſt in animal ſubſtances, but ſome traces of it have been obſerved in vegetables; for a tartarus vitriolatus is often got mixed with the vegetable alkali, procured from the aſhes of plants which have been burnt; ſome chymiſts, however, have alledged that this acid did not exiſt naturally in the plant, but that it was abſorbed by the alkaline ſalts in the aſhes; for it has been the general received opinion that this acid is perpetually floating in the air; but Profeſſor Vogel thinks that this fact is very doubtful, for that neither he nor Profeſſor Langius had been able to get one grain of a neutral ſalt, from ſalt of tartar which had been expoſed to the open air for a conſiderable length of time.

At preſent it is only extracted from *green vitriol*, and from *ſulphur*. When it is prepared from vitriol, the vitriol, after being ſlightly calcined, is diſtilled in low earthen retorts, called long necks, which are filled about one-half with the vitriol, and placed on their ſides in a reverberatory furnace, and after large glaſs receivers have been luted to theſe retorts, either with or without the intervention of a long glaſs tube, called an adopter, the fire is lighted, and the heat is gradually increaſed to the utmoſt, and kept up as long as any vapours ariſe.

The other ſubſtance from which this acid is prepared, is ſulphur; which was alledged to contain it in ſuch quantity, that a pound of ſixteen ounces was ſaid to yield above fifteen ounces and a half of this acid; but from the experiments made by the ingenious Mr. Kirwan, an account of which is publiſhed in the 72d vol. of Philoſophical Tranſactions for the year 1732, it appears that a hundred grains of ſulphur contain $40\frac{61}{100}$ grains of phlogiſton, and only $59\frac{39}{100}$ grains of this acid.

The method in which it has generally been ordered to be prepared from ſulphur, is, to melt it in a large crucible, or other earthen veſſel; and after ſetting it on fire, to hang over it, at a proper diſtance, a very large glaſs veſſel; made ſomewhat like a bell, with a groove in the inſide at the bottom, which has a ſpout going out from it, to convey any liquor formed by the ſulphureous vapour condenſing on the inſide of the glaſs, into a receiver luted to the end of the ſpout. For the performance of this proceſs with advantage, ſeveral things are requiſite to be obſerved. 1. That the glaſs bell be hung at ſuch a diſtance from the burning ſulphur, that the flame do not touch it. 2. That the glaſs veſſel (or bell) be large, and the aperture for the admiſſion of air be no larger than is ſufficient for the purpoſe, in order that as little of the vapour may eſcape as poſſible. 3. That an aqueous vapour be admitted to unite with and condenſe the vitriolic vapour, which is in a very volatile ſtate as it ſeparates from the ſulphur; which may be done by either moiſtening the inſide of the bell with the ſteam of warm water, before it is ſet over the burning ſulphur, or by admitting a watery ſteam during the operation. 4. That after the ſulphur has continued burning for ſome time, it is requiſite to ſtir it more than once, to remove a cruſt compoſed of heterogeneous matter, which forms on the ſurface, and prevents the ſulphureous ſteam from riſing.

In order to remedy many of the inconveniencies ariſing from the old methods of preparing this acid, the manufacturers of this article now uſe very large glaſs veſſels, capable of containing a hogſhead or more, with a ſmall opening in the ſide; and they mix a ſmall portion of powdered nitre with the ſulphur, to make it burn the eaſier, and only make uſe of the pureſt ſulphur; and they admit, by the air hole in the ſide, a ſufa ſufficient quantity of aqueous vapour for condenſing the ſulphureous ſteam.

The acid obtained in this way from ſulphur is in all reſpects the ſame as that got from vitriol, only when firſt drawn is more volatile, owing to its having a greater mixture of phlogiſton; but it becomes more fixt by letting it ſtand in unſtopped bottles for ſome days.

This acid when firſt got, either from ſulphur or vitriol, is mixed with a large proportion of water, and with a quantity of phlogiſton or inflammable matter, which gives it a black colour; and therefore it is neceſſary to rectify it by diſtilling it a ſecond time in a glaſs retort placed in a ſand heat; but in this ſecond operation it is neceſſary to apply only ſuch a degree of heat as is capable of raiſing the watery parts, together with the lighter moſt volatile parts of the acid; in doing of which the phlogiſton will be diſſipated, and the acid remaining in the retort will be ſufficiently concentrated, for moſt purpoſes for which it is wanted; and will gradually loſe its black colour, and become clear and tranſparent, which is the common mark for diſcontinuing the operation.

The directions which Monſ. Macquer gives for the performance of this ſecond diſtillation, is to raiſe the fire by degrees till the liquor in the retort appears to boil gently, and to go on with the diſtillation, keeping the liquor thus gently boiling till you have drawn off a half or two-thirds of the contents of the retort, according as you wiſh that the acid ſhould be more or leſs concentrated.

The liquor which comes over firſt in this ſecond diſtillation, is clear and ſcarce taſtes ſour, but what comes over afterwards ſlowly in drops is the lighteſt part of the acid, united with a quantity of water, which has formerly been called the weak ſpirit of vitriol.

Drs. *Boerhaave*, *Vogel*, and all other chymiſts agree that it is a very tedious and troubleſome operation, to attempt to rectify the vitriolic acid by diſtilling it all over, for it requires a heat above 600 degrees for this purpoſe, and there is a great deal of danger of breaking the glaſſes; and for theſe reaſons is ſeldom practiſed, as it is rendered ſufficiently ſtrong for moſt purpoſes for which it is wanted, by drawing off the watery phlegm and phlogiſton.

This acid is generally fluid, but ſometimes it is got in form of large cryſtals, which is ſuppoſed to be owing to its having a mixture of phlogiſton; becauſe it is ofteneſt met with in this ſtate, when it is diſtilled from ſulphur, and it is not ſtronger than other concentrated vitriolic acid that we have in a fluid ſtate.

The acid of vitriol, when pure, is of a fixt nature, but it may be rendered volatile by the addition of a phlogiſton; thus if you mix it with a hepar ſulphuris, made with a cauſtic alkali, it becomes immediately volatile; or if you receive the fumes of ſulphur on a cloth wetted with a ſolution of fixt alkali, the fumes and alkali immediately unite and form ſmall cryſtals of a tartarus vitriolatus, which can be decompoſed, and its acid made to evaporate by the addition of any vegetable acid.

However, there is ſomething very remarkable with regard to the mixture of phlogiſton with this acid, which is, that although a certain ſmall given quantity renders this acid elaſtic, light, and ſo volatile that its penetrating ſmell threatens ſuffocation, yet when it is fully ſaturated with phlogiſton, it becomes more fixt than before, and aſſumes the form of common ſulphur.

The vitriolic has the greateſt ſpecific gravity, and is the ſtrongeſt of all the acids; the weight of the pureſt that is commonly prepared, is to that of water as 1845 to 1000; though Mr. *Baume* and Sir *Torbern Bergman* have rectified it ſo much, that it weighed as 2,125 to 1000. For medical purpoſes it is ſufficiently pure if its ſpecific gravity be as 1800 to 1000. This concentrated acid, if kept in bottles that are not well ſtopt, ſoon abſorbs water and a portion of phlogiſton; and it becomes black and ſpecifically lighter.

It unites with all the other acids, and with water; and generates a degree of heat with them on mixture.

It effervesſces with, and diſſolves the mild fixt, and the volatile alkalies; with each of them it forms a different neutral ſalt, and has a greater affinity with them than any other of the acids; but if it be rendered volatile, or exiſts in that form in any liquid, it may be diſlodged by them.

The neutral ſalts which it forms with the three alkalies, are,

Acid.	*Alkali.*	*Neutral ſalt.*
Vitriolic acid.	Vegetable.	Vitriolated tartar.
	Foſſil.	Glauber ſalt.
	Volatile.	Vitriolated ſal ammoniac.

Monſ. Homberg, in the Memoirs of the French Academy of Sciences for the year 1699, tells us, that he ſaturated an ounce of ſalt of tartar with the vitriolic acid, and that, on evaporating to dryneſs the neutral ſalt formed thereby, it weighed 3 drams and 5 grains more than the ſalt of tartar; which additional weight he reckons to be that of the pure acid which ſaturated the ſalt of tartar, and from hence he concludes that an ounce of the oil of vitriol contains half an ounce and 56 grains, or 292 grains of pure acid. But by Mr. Kirwan's experiments, mentioned in Phil. Tranſ. vol. 71. the ſame quantity of the vitriolic acid, whoſe ſpecific gravity was

1819,

1819, only contained $213\frac{3}{10}$ pure acid. As both theſe gentlemen's experiments were made with tartarus vitriolatus, to determine the real quantity of acid it contained, Mr. Kirwan accounts for the difference of their calculations from Monſ. Homberg having made no allowance for the water which the vitriolated tartar took up; imagining that the whole additional weight which the vegetable alkali acquired by being ſaturated with the vitriolic acid, and converted into a dry neutral ſalt, was pure acid; and from the ſalt of tartar they uſed having different degrees of exſiccation. By Mr. Kirwan's experiments, 100 grains of dry tartarus vitriolatus contained $66\frac{67}{100}$ grains of ſalt of tartar, $28\frac{51}{100}$ grains of pure vitriolic acid, and $4\frac{82}{100}$ grains of water.

2. The vitriolic acid mixed with unctuous oils, ſuch as thoſe of almonds, or of olives, &c. and even with the eſſential oils, immediately blackens them, and renders them more ſolid. The mixture with the unctuous or more earthy oils, by keeping, acquires conſiſtence and properties approaching to thoſe of a bitumen; with the

lighter more volatile oils, it acquires the properties of a reſin. And from the mixture of either the unctuous or eſſential oils with this acid, by proper management, a true ſulphur may be prepared.

Dr. Vogel, and Dr. Morveau, both remark that the vitriolic acid, in its moſt concentrated ſtate, does not cauſe oils of any ſort to burſt out into flame, as the nitrous acid does; but if mixed with equal quantity of the nitrous acid, it raiſes a flame in many oily bodies, which the nitrous acid by itſelf did not effect.

It unites with ardent ſpirits, and thereby loſes its acidity, or is dulcified, as it is commonly termed; and from this mixture the *dulcified ſpirit of vitriol,* the *oleum dulce vitrioli*, and *Hoffman's anodyne liquor*, are prepared; but of theſe I ſhall treat more particularly when I conſider the ardent ſpirits.

3. It diſſolves ſilver, copper, iron, lead, tin, cadmia, zinc, the minerals of arſenic; but regulus and glaſs of antimony, quickſilver, and arſenic, are only corroded and taken up in part; it does not attack gold in its

metallic ſtate, but immediately attacks its calx precipitated from aqua regia.

It requires particular management in effecting each of theſe ſolutions, for the acid requires to be concentrated to diſſolve ſome of theſe metals, and to be diluted to effect others, and it muſt be made of a boiling heat to diſſolve ſome, and ſo forth.

The ſolutions of *copper*, of *iron*, and of *zinc*, in this acid, afford the *blue*, the *green*, and the *white vitriols*; and the ſolution of *quickſilver*, the *mercurius flavus*, commonly called turpeth mineral; which metallic ſalts have been long adopted by moſt pharmacopoeias in Europe.

Acid.	*Metal.*	*Metallic ſalt.*
Vitriolic acid.	Copper.	Blue vitriol.
	Iron.	Green vitriol.
	Zinc.	White vitriol.
	Quickſilver.	Yellow mercury, or turpeth mineral.

4. It unites with the abſorbent earths, loſes its acidity by this combination, and forms neutral earthy ſalts with them. With calcarious, gypſeous and talky earths, it produces *ſelenites*, *gypſum* and *talk*; with an aluminous earth, *alum*; with magneſia,

magneſia vitriolata, or Epſom ſalt, and ſo forth.

The alum and the Epſom ſalt are the only two adopted into the London pharmacopoeia.

Acid.	*Earth.*	*Earthy ſalt.*
Vitriolic acid.	Aluminous.	Alum.
	Magneſia.	Magneſia vitriolata, or Epſom ſalt.

5. The vitriolic acid has a very ſtrong attraction with water, for if it be pure and expoſed to the air, it ſoon attracts a conſiderable quantity of water, increaſes in its weight and bulk, though it diminiſhes in its ſpecific gravity. It generates heat on its mixture with water, but increaſes cold when poured on ice or ſnow, a phænomenon which chymiſts have not hitherto been able to explain.

This acid in its concentrated ſtate is extremely cauſtic, and acts in ſome meaſure, like fire on animal and vegetable ſubſtances; it immediately turns them black, corrodes and deſtroys them. It coagulates the blood, and all animal juices which can be coagulated by heat. It checks all fermentation in both animal and vegetable liquors; and hence it has been mixed with water, to preſerve it ſweet in long ſea voyages; and it has been added to vinous liquors, to ſtop their fermentation; and it has been much uſed by way of a medicine, to prevent the too great tendency of the animal fluids to putrefaction in warm climates, and in putrid diſeaſes.

SECT. III.

Of the Nitrous Acid.

THIS acid is got from no other ſubſtance, hitherto known, except that neutral ſalt called nitre, which is formed by its union with a fixed vegetable alkali.

The greateſt quantity of nitre that is at preſent uſed in this country, is brought from the Eaſt Indies, where it is prepared from certain earths, highly impregnated with it, by ſimply lixiviating them with water, the particulars of which ſhall be taken notice of when we treat of nitre.

The acid is ſeparated from nitre, either by the mere force of fire, or by adding to nitre a proper quantity of vitriolic acid, which having a greater affinity with its alkaline baſis than its own acid, ſets that at liberty and occupies its place; and the concentrated nitrous being of a volatile nature, immediately riſes in form of reddiſh vapours, or fumes, on being ſet looſe.

1. When this acid is to be ſeparated by the mere force of fire, the nitre muſt be mixed with ſand, or brick-duſt, or with powdered zinc, or ſome other ſuch ſubſtance, before it is put into the retort, both to prevent its fuſion and to increaſe the heat; but this method is ſeldom practiſed, as the nitrous acid is got much eaſier in the other way.

2. When this acid is to be procured by the addition of the vitriolic acid, the nitre is firſt to be put into a retort, and the acid is to be carefully and gradually added to it under a chimney, after which a large receiver is to be luted to the retort, and

firſt a gentle and afterwards a ſtronger heat applied, till all the acid has come over.

In diſtilling the acid of nitre, and other volatile mineral ſubſtances, Dr. Vogel and other chymiſts have recommended to put a long glaſs tube (called an adopter) between the retort and receiver, and to uſe a tubulated inſtead of a plain receiver; as the operation will be conducted with greater eaſe and ſafety, the volatile fumes having more ſpace, and the receiver being kept more cool; and ſhould the vapours riſe too quickly, part of them may be drawn off into another receiver fixed to the end of the tube of the firſt.

This acid is generally in a fluid ſtate, and when highly concentrated is of a reddiſh colour, and emits red ſuffocating fumes; but if it be diluted with water, it becomes colourleſs, and more fixt, and does not ſmoke or throw out fumes as before.

But although it is almoſt always got in a fluid ſtate, yet Dr. Vogel mentions its being ſometimes procured in a ſolid form, when ten or twelve pounds of nitre have been mixed with an equal quantity of calcined vitriol, and diſtilled together, to make aqua fortis. He ſays this ſolid acid is not to be found in the receiver, but adhering to the glaſs tube that is put between the retort and it; that it is ſometimes procured to the quantity of half an ounce, nay, ſometimes of an ounce, and is of a white colour, and emits red fumes ſo ſoon as the air is admitted.

It is often mixed with a ſmall portion of the vitriolic or marine acids, from which it may be ſeparated by dropping a ſolution of ſilver in the nitrous acid itſelf, into the acid we want to purify; when each drop will occaſion a milky cloud, which will fall to the bottom of the veſſel in form of a white powder, till it is quite freed of theſe foreign acids; after which no more milky clouds will appear on dropping the ſolution; for theſe clouds were occaſioned by the marine or vitriolic acids, which have a greater affinity with ſilver, than the nitrous, laying hold of the ſilver and precipitating with it to the bottom.

This acid, and the nitre from which it is got, have been generally claſſed among the foſſil ſubſtances, though many have doubted whether it ought to be placed among them or not; for although it be true that nitre is got native from certain earths in the Eaſt Indies, yet it is prepared by art in many places of Europe, from earths which have been mixed with putrid vegetable and animal ſubſtances, and with the vegetable fixt alkaline ſalt. Mr. Pietſch, in the Memoirs of the Royal Academy at Berlin, for the year 1750, mentions his having wetted a calcarious ſtone with urine mixed with the vitriolic acid, which, after it had ſtood a conſiderable time, was found to be ſtrongly impregnated with nitre. At preſent they prepare a great quantity of nitre in Germany, and other countries, in the following manner: they raiſe walls or dykes of a mud, compoſed of earth got near to towns or villages, lime, rubbiſh of old houſes, ſtraw, and wood aſhes, which they mix with urine; and when the dykes are about 10 or 12 feet high, they thatch them with broom, to defend them from the rain, and leave them in this ſtate for a year, taking care to drench them frequently with urine. At the end of twelve months the walls or dykes begin to throw out a nitre, in form of a ſaline cruſt, on their ſurface, which is ſuppoſed to have been formed by the alkaline ſalt of the aſhes, and an acid ſaline principle, which has been attracted from the air, and converted into the nitrous acid, by the putrefaction of the ſubſtances of which the dykes were compoſed. For ten years theſe dykes continue to throw out nitrous cruſts, which are gathered once in eight days; and when a ſufficient quantity of them has been got, they are lixiviated with water, which, after being ſufficiently purified, is evaporated, to allow the nitrous cryſtals to ſhoot.

The ſpecific gravity of this acid to that of water, is commonly reckoned to be as 1400 to 1000. Monſ. Baume ſays, he purified it till its ſpecific gravity was 1500; and Sir Torbern Bergman, till it was 1586.

The more this acid is concentrated, the more volatile it becomes; and the more it is diluted, the more fixt it is, which is contrary to what we obſerved of the vitriolic acid.

1. It has a greater affinity with the fixt and volatile alkali than any other acid, except the vitriolic; and by Mr. Homberg's experiments, it took 10 drams, 36 grains of it, to ſaturate an ounce of the ſalt of tartar; and the neutral ſalt, formed by this union, weighed an ounce and 3 drams; hence he concluded, that an ounce of this acid contained 2 drams and 38 grains of mere acid.

By Mr. Kirwan's experiments, 100 grains of dried nitre contains $28\frac{48}{100}$ grains of mere acid, $5\frac{2}{10}$ grains of water, and $66\frac{32}{100}$ grains of fixt alkaline ſalt.

The neutral ſalts, which this acid forms with the three alkalies, are,

Acid.	*Alkali.*	*Neutral ſalt.*
Nitrous acid.	Vegetable alkali.	Common nitre.
	Foſſil alkali.	Cubic nitre.
	Volatile alkali.	Ammoniacal nitre.

2. The nitrous acid joins with oily bodies, with a greater degree of efferveſcence,

cence, and more fumes, than the vitriolic; and the mixture with ſome of the ponderous eſſential oils, got from foreign aromatic plants, raiſes ſuch a degree of heat as to burſt out into flames. Dr. Vogel ſays, that this phænomenon of catching flame, holds not only with the eſſential oils of turpentine, cloves, ſaſſafras, cinnamon, carvi, juniper, lavender, and lemons, but likewiſe with the expreſſed oils of linſeed, nuts, and hemp, and with the empyreumatic oil of guaiacum; but not with any other eſſential or expreſſed oils which he ever tried. But if an equal quantity of the vitriolic be added to this acid, then the ſame thing happens on its being mixed with the balſams of Mecca, of copaivy, and of turpentine; and the balſam of Mecca, on flaming, makes an exploſion like the firing of a cannon.

With the foſſil oils it generates heat, but no flame.

When mixed with ardent ſpirits, a great efferveſcence, heat, and copious fumes are excited; and from this mixture the nitrous *æther*, and *dulcified ſpirit* may be prepared: but of theſe hereafter.

When diſtilled to dryneſs, with the horns or hoofs of animals, or ſuch other combuſtible matters, the whole takes fire, and burſts the glaſſes with a moſt violent exploſion; and Dr. Vogel alledges that a genuine ſulphur may be got, by diſtilling the oil of turpentine mixed with this acid.

3. It acts readily on metals, and diſſolves moſt of them, except gold. Dr. Vogel ſays, it concretes with ſome of them, ſuch as iron and copper, into a deliqueſcent ſubſtance, but forms cryſtals with ſilver, lead, and mercury.

The only metallic ſalts made with this acid, which have a place in the London Diſpenſatory, are two, one prepared with ſilver, the other with mercury, to wit, the *lunar cauſtic*, and the *mercurius corroſivus ruber*.

4. It diſſolves all the calcarious earths, and ſuſpends them in a fluid form, and renders them volatile, ſo as to riſe in diſtillation; and the ſalts formed by evaporating the ſolutions of theſe earths, is of a

very deliqueſcent nature; and Dr. Vogel ſays that it changes chalk into a kind of phoſphorus, which emits light, but does not burn.

5. It does not excite ſo much heat with water as the vitriolic acid, but produces a greater degree of cold with ſnow.

It diſſolves and deſtroys the ſolid parts of animal and vegetable ſubſtances more readily than the vitriolic acid, but it does not coagulate the fluids ſo much. In its concentrated ſtate it is more volatile than the vitriolic acid, but becomes fixed by the addition of water.

It has a peculiar property of fixing air, which is eaſily ſeparated from it by heat; and hence it is uſed as the baſis of gunpowder, of the pulvis fulminans, and of other exploding compoſitions.

The nitrous acid itſelf is ſeldom uſed as an internal remedy, from a belief of its being too fiery and ſtimulating; but how far this opinion is well founded I cannot ſay.

SECT. IV.

Of the Marine, or Muriatic Acid.

THE marine acid is never found pure; and the only natural body that affords it, is ſea ſalt; ſal ammoniac, from which it is likewiſe to be got, being looked upon more as a production of art, than of nature.

The great reſervoir of the marine ſalt is the ſea; and the great mines of it, and the ſalt ſprings, which have been diſcovered in Poland, England, and other countries. It likewiſe exiſts in the vegetable and animal kingdoms, for it has been found mixed with lixivial ſalts and aſhes of many plants, and has been procured from the urine of many animals.

The acid is ſeparated from the ſea ſalt, either by the mere force of fire, after mixing it with bole to increaſe the heat, and to prevent its fuſion; or by adding the acid of vitriol to it, which has a greater affinity with its alkaline baſis (the foſſil alkali) than it.

The fumes of this acid are very elaſtic, and therefore if we prepare it without the addition of water, it is right to put a long glaſs tube (an adopter) between the retort and receiver, and likewiſe to uſe a tubulated receiver, to prevent the veſſels from burſting; but as we ſeldom want this acid perfectly pure, water is commonly added to it in the diſtillation, which renders it more fixt and more manageable.

This acid is of a light yellow colour, and has a peculiar ſmell. Its ſpecific gravity is commonly reckoned to be to that of water, as 1210 to 1000; though authors ſeem to differ greatly on this point. Monſieur Baume eſtimates it at 1187; Sir T. Bergman, at 1,190; Mr. Homberg, at 1300: and Dr. Prieſtley alledges that he has rectified it till it weighed 1500.

1. It has a greater affinity with the alkaline ſalts, than the vegetable acid, but leſs than either the vitriolic or nitrous.

By Mr. Homberg's experiments, it took

two ounces and five drams of this acid to ſaturate an ounce of ſalt of tartar; and the neutral ſalt prepared from thence weighed one ounce 14 grains; from hence he concluded that an ounce of ſpirit of ſea ſalt contains only one dram and 15 grains of real acid.

By Mr. Kirwan's experiments, a hundred grains of perfectly dried digeſtive ſalt (the ſalt made with the vegetable alkali and the marine acid) contained 28 grains of mere acid—$6\frac{55}{100}$ grains of water—and $65\frac{40}{100}$ of fixed alkali.

The neutral ſalts made with this acid and the three alkaline ſalts are

Acid.	*Alkali.*	*Neutral ſalt.*
Marine acid.	Vegetable.	Digeſtive ſalt.
	Foſſil.	Common ſea ſalt.
	Volatile.	Common ſal ammoniac.

2. It ſcarcely unites with oily bodies; but it acts readily on the mucus, with which they are often mixed, and thereby renders them purer.

It unites readily with ardent ſpirits, but ſcarcely produces any heat or effervefcence with them. Till of late it was generally believed that no dulcified ſpirit or æther could be produced by their union; but Monſieur Baume, the Marquis de Courtenvaux, and other French chymiſts, have publiſhed proceſſes, by which a true æther, more penetrating and odorous than the vitriolic, and a more fragrant oleum dulce than that obtained from the other mineral acids, can be prepared with it; the particulars of which ſhall be taken notice of, when I come to treat of ardent ſpirits and the different dulcified ſpirits and æthers.

3. It acts readily upon metallic ſubſtances, and has a greater affinity with moſt of them, than the vitriolic or nitrous acids: it diſſolves zinc, iron, copper, tin, mercury and antimony: it corrodes lead and ſilver, but does not effect gold in its metallic ſtate, unleſs joined with the nitrous acid in the proportion of one of the marine, to eight of the nitrous; when it forms *aqua regia,* which is the proper menſtruum of gold: but although it does not attack gold in its metallic ſtate, yet it diſſolves its calx when precipitated from aqua regia; and if the gold be precipitated from it, by

means of the volatile alkali, it forms the aurum fulminans.

It precipitates ſilver, lead, and mercury from the nitrous acids; with the ſilver, it forms a luna cornea; and with the mercury, ſalts of the ſame kind as the corroſive ſublimate and the mercurius dulcis. Dr. Vogel ſays, that it renders gold, ſilver, tin, regulus of antimony, and mercury, volatile.

The metallic ſalts made with this acid which have been adopted into the London Pharmacopoeia, are three; the 1. *Mercurius ſublimatus corroſivus*; 2. *Mercurius dulcis ſublimatus*; 3. *Mercurius præcipitatus albus*. But of theſe hereafter, when mercury and its preparations are conſidered.

4. It diſſolves the calcarious earths with heat and effervescence, and ſuſpends them; ſuch as lime, chalk, calcined hartſhorn, &c. and the ſalts procured from them by evaporation, are of a very deliqueſcent nature; and if dried by the fire, they become a kind of phoſphorus, which gives a light in the dark for ſome time.

5. It produces heat with water, and

cold with ſnow and ice, as the other mineral acids, but in a weaker degree.

It corrodes and deſtroys animal and vegetable ſubſtances, and coagulates the fluids as the other acids do; but as it does not touch oils, it has been much uſed by anatomiſts to corrode parts of the human body, or of other animals, the veſſels of which have been previouſly injected with coloured wax, and oil made fluid by heat; ſo that when the animal ſubſtance is diſſolved and corroded, and waſhed carefully away, the wax left behind, ſhews the ramifications of the veſſels through the part corroded.

This acid is ſpecifically lighter, and much more volatile and penetrating, than either the vitriolic or nitrous acids, and has of late been uſed in France for purifying the infected air of gaols, hoſpitals, ſhips and other infected places: the manner in which it has been done is this; a quantity of ſea ſalt is put into a large glaſs, or proper ſtone veſſel, which is placed in a table or ſtand in the middle of the chamber to be purified; or if the chamber is large, a ſand heat is placed in the middle of it, for the veſſel with the ſalt to be put on; then a quantity of the concentrated vitriolic acid, equal in weight to a third part of the ſalt, is to be poured over the ſalt: the perſon who is the operator retires immediately and ſhuts the door of the chamber after him, to prevent being ſuffocated.

SECT. V.

Of the Vegetable Acid.

THOUGH no ſubſtances have been more generally uſed, both for the preſervation of health, and the cure of diſeaſes, than vegetable acids, yet till of late they have been examined with ſo little care, by chymiſts, that it was the common received opinion, that they were all nearly of the ſame nature; and although they divided them into three claſſes; 1. The native; 2. The diſtilled; 3. And the fermented; yet they believed them to have the ſame chymical properties, and called them all by the general name of the *Vegetable Acid*; and after giving a particular account of the virtues and properties of vinegar, they imagined they had ſaid every thing that was to be ſaid of all theſe acids.

In compliance with general cuſtom, I ſhall begin with mentioning ſlightly the three general claſſes, and ſhall conſider particularly vinegar, or the acetous acid; after which I ſhall make ſome general remarks on theſe acids, and mention the names of a number of acids both of the foſſil and animal kingdom, which, thirty or forty years ago, were little known.

I. *The Native Vegetable Acid.*

THE acids called native, are thoſe got from fruits, herbs, and other plants; ſuch as lemon or orange, or cherries, ſorrel, or other fruits or plants which yield an acid, or ſour juice.

Theſe acid juices, when firſt ſeparated

from the vegetables, are mixed with a good deal of mucilaginous parts, from which they may be freed by allowing the groſſer thick parts to ſubſide, and then ſtraining them through flannel, and afterwards filtering them through paper. As they are in a very diluted ſtate, and ferment ſoon, thoſe which are intended to be kept for any time are commonly evaporated, till they become of the conſiſtence of cream, when they are called by the name of robs. In this form a great quantity of the juice of lemons, and of limes is ſent home from the Weſt Indies; it keeps long, and a ſmall quantity of it is ſufficient to acidulate a large quantity of liquor.

The acid of vegetables may likewiſe be got in a cryſtalline form, by preparing what are called their *eſſential ſalt*; which is done by clarifying the expreſſed juices of fruits or plants, and evaporating them, in glaſs veſſels, till they come to the conſiſtence of a cream; and then, putting them into wide-mouthed bottles till they riſe within the neck, add as much ſweet olive oil as will cover their ſurface; and tie over the neck a piece of wetted bladder, to prevent duſt getting into the bottle; after which ſet the bottles in a cool cellar for ſeven or eight months, in which time the eſſential ſalts will concrete into cryſtals, which are to be taken out and waſhed ſlightly in cool diſtilled water. On examination, theſe ſalts are found to contain the acid of the plant or fruit, joined to a portion of its earth and oil, ſo that they may be looked upon as a kind of tartar. Such eſſential ſalts may be prepared from moſt acid vegetables; at preſent they are prepared in large quantity from lemon and ſorrel. In this country they are not much uſed as medicines, but are moſtly employed for taking ink out of linen or cotton ſtuffs; though in Germany and other countries, they are preſcribed, as other acids, in fevers and in other diſorders.

II. *Of the diſtilled Vegetable Acid.*

MANY vegetable ſubſtances, eſpecially thoſe of the coniferous kind, and reſinous plants and woods, yield plentifully by diſtillation an acid liquor, which when purified by re-diſtilling it, has been uſed in medicine to ſupply the place of tar water, ſo much recommended by Biſhop Berkley about forty years ago. By the Biſhop's receipt, two pounds of tar were ordered to be put into a gallon of water, and to be well ſtirred about with a wooden rod, and let ſtand for two days; after which the water, which had acquired an acid taſte and an empyreumatic flavour, was directed to be poured off and kept for uſe. The principal, and I may ſay the only virtues of this water depend on the acid waſhed off from the tar, the ſame as is procured by diſtilling the fir wood: the quantity of empyreumatic oil is ſo ſmall, as ſcarce to deſerve notice. About ſixty drops of the diſtilled acid are reckoned to be ſufficient to make a pint of diſtilled water equal in acidity to the common tar water.

III. *Of the Fermented Acid.*

THE third claſs of vegetable acids mentioned, was the fermented; two ſpecies of which are in common uſe—1. Vinegar; and —2.

—2. Tartar. How far theſe two may be of the ſame nature, I ſhall not ſay; but in cryſtalliſing neutral ſalts prepared from each with the foſſil alkali, I found that the neutral ſalts formed cryſtals exactly of the ſame ſhapes, and ſo ſimilar as ſcarce to be diſtinguiſhed from one another.

The vinegar is the one which has been the moſt particularly examined, and moſt accurately deſcribed by authors of any of the vegetable acids. Dr. Stahl, in his Fundamenta Chemiæ, alledges that vinegar is entirely produced by the combination of the ſaline, the oily and the earthy parts of vegetable juices; and that ſuch liquors only as contain theſe principles, are capable of yielding it: generous wines contain theſe principles, and therefore if they be heated over a quick fire till they boil, and be afterwards ſet in a warm place for ſome days, they acquire a very acid taſte; yet when the wine is taken from the fire, ſcarce any of it is found to have evaporated. As a further proof of the truth of what he advances, he ſays, " If you boil with a ſtrong heat, ſome turpentine in an earthen veſſel, ſo that ſome of it may inſinuate itſelf into the pores of the veſſel; and then, after pouring out the turpentine, you put into it a quantity of water, in which you have diſſolved about one ſixth part of its own weight of nitre, and then boil it ſlowly for ſome time, and ſet it by in a warm place covered ſlightly, the liquor, after ſome days, will become a ſtrong and pungent vinegar."

Or if a tincture of gum anima in ſpirit, be thrown into water, and let ſtand till the reſinous parts are all precipitated, and the liquor has become clear; and this liquor is decanted off into a glaſs or ſtone veſſel, and a little nitre is added to it; and then the veſſel is ſet over a ſand heat, and is boiled for ſome time with a gentle fire, till all the ſpirit is evaporated, and it is afterwards ſet in a warm place, it will turn into a genuine vinegar.

Vinegar is commonly in a very diluted ſtate, but it may be made ſtronger, or concentrated as it is commonly called, in ſeveral ways:—1. By expoſing it to ſuch an intenſe cold in the time of a hard froſt, as will freeze its watery parts, and leave its acid pure.—2. Or by evaporating diſtilled vinegar to a ſixth, an eighth, or a twelfth part of its original quantity.—3. But the moſt common method of obtaining a pure highly concentrated acid of vinegar, is to put a large quantity of well dried diuretic ſalt, or other neutral ſalt made with vinegar, into a retort; to add to it two-third parts of its own weight of the ſtrong vitriolic acid; and then to put it into a ſand heat, and lute a receiver to the retort, and diſtil; when you may get by proper management about two-third parts of the weight of the neutral ſalt of concentrated acid. Dr. Boerhaave has recommended to draw off this concentrated acid by the force of fire, from diſtilled verdigreaſe; but as it may retain ſomething of the copper, it is not reckoned to be ſo fit for internal uſe, as that drawn off from the neutral ſalt.

1. Vinegar unites with alkalies in the ſame manner as other acids. It took fourteen ounces of the diſtilled vinegar uſed by Monſ. Homberg, to ſaturate one ounce of the vegetable alkali; and when evaporated, the neutral ſalt had acquired of additional

weight from the acid, three drams and 36 grains; from whence he concludes that an ounce of his diſtilled vinegar contained 18 grains of pure acid.

By Mr. Kirwan's experiments, 100 grains of foliated tartar contained 32 grains of fixed alkali, 19 grains of pure acid, and 49 grains of water.

As it is difficult to get diſtilled vinegar always of the ſame preciſe ſtrength, the quantity uſed to ſaturate an ounce of the pure vegetable alkali muſt vary.

The neutral ſalts made with diſtilled vinegar and the three alkalies, are the three following,

Acid.	*Alkali.*	*Neutral ſalt.*
Diſtilled vinegar.	Vegetable.	Diuretic ſalt.
	Foſſil.	Acetated Rochelle ſalt.
	Volatile.	Spiritus mindereri.

2. It unites with but few of the metals in their metallic ſtate; it diſſolves copper and lead; with copper it forms the *diſtilled verdigreaſe*; and with lead, *ceruſe* and ſaccharum ſaturni.

It has no effect on gold or ſilver in their metallic form, but diſſolves their calces precipitated,

precipitated from aqua regia, and ſpirit of nitre, by a fixt alkali.

It draws a deep red tincture from iron; and the iron precipitated from it by Pruſſian alkali, acquires a fine blue colour.

It acts very faintly on quickſilver in its metallic ſtate, but when it has been diſſolved in the vitriolic or in the nitrous acids, and has been precipitated from them by a fixt alkali, or when it has been reduced to the ſtate of a calx by the force of fire, it diſſolves theſe calces, and forms with them a cryſtalliſed mercurial ſalt, which is the baſis of Keyſer's pill.

It has been generally believed to act powerfully on the regulus of antimony, but Monſ. Monet alledges that it has little effect upon it.

It diſſolves zinc and its flowers, and a pure cryſtalliſed metallic ſalt may be obtained from thence.

It acts upon arſenic, but not upon cobalt.

3. It does not, even in its concentrated ſtate, affect either the unctuous or eſſential oils more than water, though we find it mixed

with them in the vegetable kingdom, and it may in part be united to them by diſtillation.

4. It diſſolves the calcarious earths in the ſame way as the other acids; and the French uſe the earthy ſalts made with it as medicines; the ſalt of coral—of crabs eyes—of pearl, &c. but they are never given in England as medicines.

5. It mixes eaſily with water without any heat or effervеſcence.

It acts on, and diſſolves by long digeſtion, animal as well as vegetable ſubſtances, and ſoftens horn, bone, &c.

By particular management Monſ. Morveau obtained an æther from the mixture of this acid with ardent ſpirits; the particulars of which ſhall be taken notice of when we come to treat of the different kinds of æther.

Mr. Kirwan affirms, that the greateſt ſpecific gravity of the ſtrongeſt concentrated vinegar yet made, was as 1,069 to 1000.

The other ſort of fermented acid mentioned, was the tartar, which Sir T. Bergman ſays is not a pure acid, but a tartus tartariſatus, with a determined exceſs of an acid, or a ſalt which contains a quantity of the vegetable alkali combined with a greater proportion of its own acid than is neceſſary for ſaturation; and therefore that it may be looked upon more as a half neutraliſed ſalt than as a pure acid.

CHAP. III.

SECT. I.

Of the Variety of Vegetable and other Acids.

I HAVE already obſerved that Dr. Vogel and others had ſuſpected that if vegetable acids were particularly examined, they would be found to differ from one another, and to have different degrees of affinity and other properties, in the ſame manner as the mineral acids; to confirm which Dr. Vogel mentions, that if Rochelle ſalt be thrown into a decoction of tamarinds, the alkaline baſis of the Rochelle ſalt will unite with the acid of the tamarinds, and the cryſtals of tartar will be precipitated.

Having long ſuſpected, from the taſte and ſmell, that vegetable acids differed materially from one another, I in the year 1767, on reading what Dr. Vogel had ſaid on this ſubject, began to conſider whether ſome method might not be fallen upon to determine this queſtion; and on recollecting that the Rochelle ſalt concreted into large ſolid cryſtals, which preſerved their figure long, even in an open veſſel, though the tartarus tartariſatus always appeared in form of a powdery foliated ſalt, which run ſoon per deliquium, when expoſed to the air; I imagined that if we were to unite the foſſil or mineral alkali with different vegetable acids, we ſhould be able to obtain true neutral ſalts in form of regular cryſtals, which would in ſome meaſure ſhew how far theſe acids differed or approached to each other in their nature and properties; and upon trial I found that I had judged right, for each particular acid yielded a neutral ſalt peculiar to itſelf; and in December 1767, I gave in to the Royal Society a paper containing an account of 22 different neutral ſalts made with vegetable acids, and the native foſſil alkali of Tripoli; and of two ammoniacal ſalts, one made with the volatile alkali and the flowers of benzoin, and the other with the volatile alkali and the ſal ſuccini; which paper was publiſhed in the year 1768, in the 58th volume of the Philoſophical Tranſactions, along with the figures of the ſalts, in order to ſhew that they differed materially from one another.

The account of theſe ſalts was divided into four ſections; the firſt containing the deſcription of 12 neutral ſalts made with native vegetable acid and the foſſil alkali; which were,

Neutral Salts of the Firſt Section.

1. Of lemons.
2. Of limes.
3. Of Seville oranges.
4. Of peaches.
5. Of currants.
6. Of gooſeberries.
7. Of apples.
8. Of wild ſorrel.
9. Of tamarinds.
10. Of plums.
11. Of mulberries.
12. Of grapes.

Section

Section 2.

Contained the deſcription of five neutral ſalts made with fermented vegetable acids, which were,

1. Of common wine vinegar.
2. Of diſtilled vinegar.
3. Of tartar.
4. Of verjuice (of apples.)
5. Of perry (from pears.)

Section 3.

Contained the deſcription of three neutral ſalts made with diſtilled vegetable acids, which were,

1. Of guaiac wood,
2. Of fir wood.
3. Of honey.

Section 4.

Contained the account of two neutral ſalts formed with the foſſil alkali, and two with the volatile, and flowers of benzoin, and ſal ſuccini.

1. Flowers of benzoin with fixt alkali.
2. ——————with volatile alkali.
3. Sal ſuccinum and fixt alkali.

——————— and volatile alkali.

From the account given of theſe ſalts I drew the following concluſion:

That from the experiments related, it was evident, that phyſicians had hitherto been in a great miſtake, in believing that all vegetable acids were nearly of the ſame nature; for from them it ſhould ſeem, that almoſt each of the acids called vegetable, has ſomething peculiar to itſelf, and upon future trials may be found to have different virtues and properties.

However it ought to be remarked, that when any of the concentrated ſaturated liquors ſtood for ten or twelve days before they cryſtallized, for the moſt part ſome cryſtals of a flat ſquare, or of a narrow oblong parallelogram figure were found adhering to the ſides of the cup or baſon in which the liquor ſtood; but whether this was owing to the alkaline baſis of theſe ſalts, or to the acids approaching to each other in their nature, is what can only be determined by future experiments.

The different appearance of the neutral ſalts above mentioned, from thoſe produced by the union of the foſſil alkali with any of the mineral acids, ſeems to make it doubtful whether the vegetable acids derive their origin from the mineral, or whether they are not new ſubſtances, generated either in the veſſels of the plants, by means of the vegetative proceſs, or by fermentation, or by the force of fire. If they owe their origin to the mineral acids, they are certainly ſo much changed in their virtues and properties by the combination of new particles, and by the proceſſes they have undergone, that they may be looked upon as diſtinct bodies in many reſpects.

From what has been ſaid it is evident, that the number of true neutral ſalts, or thoſe compoſed of an acid and an alkali, is infinitely greater than what has been ſuppoſed, of late, by chymiſts; and it is probable that many of the neutral ſalts above deſcribed may prove to be excellent remedies in the cure of diſeaſes, as well as uſeful in many manufactories.

As there is ſuch a variety of vegetable acids in nature, and as each of them produces a diſtinct neutral ſalt with each of the three alkalies, I think it would be right to diſtinguiſh them from one another by particular names; the ſalts made with the vegetable alkali may be called *vegetable neutral ſalts*; thoſe made with the foſſil alkali, *foſſil neutral ſalts*; and thoſe made with the volatile alkali, *volatile neutral ſalts*. Thus we may call the three neutral ſalts made with lemon juice,

1. Vegetable neutral ſalt of lemons.
2. Foſſil neutral ſalt of lemons.
3. Volatile neutral ſalt of lemons.

By means of theſe neutral ſalts we may be enabled to diſcover many of the properties of vegetable acids, and particularly, the different degrees of affinity or attraction between them and alkaline ſalts: thus for example, if we diſſolve in water, ſome of the foſſil neutral ſalt of currants, and add ſome lime-juice or ſome vinegar, and then evaporate and cryſtallize, and thereby obtain a foſſil neutral ſalt of currants, we conclude that the acid of currants has a greater affinity or attraction to the alkali, than the acid of the limes or of vinegar; but if we get a neutral ſalt of limes or of vinegar, we conclude that theſe acids have a greater degree of affinity with the alkali than the juice of currants.

As I am ſenſible that this account of the neutral ſalts of vegetables is very incomplete, and that I have done little more than given a very ſuperficial deſcription of their external appearance; and as it will probably require a length of time, and the labours of many, to diſcover fully their virtues and properties, I ſhall recommend it to thoſe who may proſecute this ſubject, to endeavour to aſcertain the following facts.

1. What degree of cold or of heat is generated, on the mixture of each acid with the different alkaline ſalts; and likewiſe to try the ſame experiments with each neutral ſalt, at the time of its ſolution in water.

2. What quantity of pure alkaline ſalt it takes to ſaturate any determined quantity of each of the vegetable acids.

3. What figure each neutral ſalt aſſumes when it is firſt cryſtallized; and likewiſe after it has been purified, and again diſſolved in water and cryſtallized.

4. What quantity of water it takes to diſſolve any determined quantity of each ſalt.

5. What effects theſe ſalts, or their ſolutions in water, have with oils, ſulphur, ardent ſpirits, metals, earths, and other ſubſtances; what ſubſtances they mix eaſily with, and to what bodies they prove a menſtruum, or aſſiſt in diſſolving.

6. How far they agree in their virtues and properties with the neutral ſalts made with mineral acids, and with each other.

7. What effects they have on the human body; whether they promote more particularly the perſpiration, or the ſecretion by the kidnies; or whether they act more readily on the bowels, and promote the diſcharge by ſtool; and to aſcertain the exact and proper doſes of each.

8. And laſtly, what effects fermentation and diſtillation have on native vegetable acids; and to obſerve and compare the appearances of the neutral ſalts made with theſe acids in their different ſtates, viz. 1. In their native ſtate; 2. When made into wine; 3. When made into vinegar. And likewiſe when made with acids brought over by the force of fire, or diſtilled

led from the ſame juices in each of the three different ſtates mentioned.

And in order to facilitate their labours, I ſhall conclude with obſerving,

1. That all vegetable juices, uſed for making neutral ſalts, ought to be ſtrained through a cloth, and then filtered through paper before they are ſaturated with the alkaline ſalt; and that after they have been ſaturated, they ought to be allowed to ſtand for ſome days, and ſome of them for weeks, and then be filtered through paper again before they are evaporated.

2. That it is of uſe to clarify many of theſe juices, after being ſaturated with the whites of eggs.

3. That it is ſometimes eaſier to obtain a neutral ſalt, by evaporating with a boiling heat, than with a ſlow or gentle fire; as the heat of boiling water coagulates and throws up a quantity of viſcid juices to the ſurface, which cannot be ſeparated by any other means.

4. That the ſweeter any fruit is, and the more it abounds with ſaccharine or viſcid juices, the more difficult it is to obtain a

neutral ſalt; and for this reaſon I was not able to procure any neutral ſalt from the ſaturated juices of pears or of cherries.

5. That in caſes where I was obliged to employ water mixed with the fruits cut ſmall or beat in a mortar, inſtead of the juices themſelves; it is right to peel off the ſkins, before we attempt to ſaturate the acid, otherwiſe the alkaline ſalt is in danger of uniting with, and rendering ſoluble in water, the groſs oils, with which the ſkins generally abound, which afterwards prevent the cryſtallization of the neutral ſalts.

The hints which Profeſſor Vogel has thrown out in his Inſtitutiones Chemiæ, and the proofs which I brought, of vegetable acids being different from one another, and of each of them having different properties, have ſince been confirmed by a number of experiments made with theſe acids, by Sir Torbern Bergman, and Monſ. Morveau, and other able chymiſts; and in Sir Torbern's tables of elective attractions, we have long columns of the affinities of ſeveral of theſe acids; of ſugar, of tartar, of ſorrel, of lemon, of benzoin, of amber, of diſtilled vinegar; which ſhew the degrees of elective attractions with different ſubſtances, and in the deſcription of the columns, properties peculiar to each of them are mentioned.

Beſides the acids already taken notice of, many others have been diſcovered by modern chymiſts, ſome few of which I ſhall here conſider.

I. *Aerial Acid.*

1. FIXED air, or that air which is ſeparated from calcarious earths and mild alkaline ſalts, on the addition of an acid; and which ſeparates from fermenting vinous liquors, and from many mineral waters, as they riſe from their ſprings, has been diſcovered to be an acid of a particular kind, and is now called by the name of aerial acid, as well as by that of fixed air.

Dr. Black was the firſt who diſcovered that it was the depriving calcarious earths of their fixed air, by calcination, which reduced them to the ſtate of lime, and rendered them ſoluble in water; that the depriving fixed and volatile alkalies of this air rendered them cauſtic; and that the reſtoring the air to quicklime, and to cauſtic alkaline ſalts, reduced the lime back again to the ſtate of calcarious earth, and rendered the alkaline ſalts mild again. Dr. Macbride afterwards, on making experiments with lime-water, found that though the addition of a ſmall quantity of fixed air made it drop its earth, yet that on adding a ſuperabundant quantity of the ſame air, it reſtored to the water its ſolvent power, and enabled it to take up again the earth which it had dropt. And by later experiments, it has been diſcovered, that this fixed air, as it was called, is an acid of a peculiar kind, and has the following properties.

It changes the blue colour of vegetables to a red; and hence Dr. Lucas obſerved a red colour in the Spa water, on the addition of ſyrup of violets. It gives water an acidulous taſte, and enables it to ſuſpend iron, and calcarious earths and ſulphur, and is what uſed to be called the mineral ſpirit in waters. It preſerves animal ſubſtances from corruption, and even renders them ſweet after they have become putrid. It extinguiſhes flame, and vegetable as well as animal life.

2. An acid has likewiſe been found mixed with dew, in ſeveral parts of the Eaſt Indies. Dr. Grimmius, in the Miſcellan. Nat. Curioſor. Dec. 2, Ann. 4, Obſ. 56, mentions a dew, which he cauſed to be gathered early in the morning, in the iſland of Batavia, in the Eaſt Indies, which had an acid taſte, and which, when concentrated, corroded iron, and formed a vitriolum Martis. The truth of this fact had been long doubted, but ſhould ſeem to be confirmed by the account given by Mr. Brown, ſurgeon to the Cygnet ſloop of war, which has been publiſhed by Dr. Duncan, in the 11th vol. of his Medical Commentaries, of an acid dew which falls yearly, in Auguſt and September, at Gundore, a village about nine miles diſtance from Mauſulipatam, on the coaſt of Coromandel, which lies in north lat. 16° 8′ and longit. 81° 2′ from London. In the year 1785, while the Cygnet ſloop lay at Mauſulipatam,

ſulipatam, Mr. Brown had a bottle full of this dew, which had been collected the preceding year, given him: it was a very ſtrong pleaſant acid liquor; and he ſays that it was eſteemed to be a powerful remedy for the cure of bilious complaints. It is collected by ſpreading pieces of muſlin on the gram (a ſpecies of pea), or on other buſhes, in the evening, and by wringing and ſqueezing them, while yet wet with the dew, very early in the morning, and receiving the liquor which comes from them into proper veſſels ſet to receive it. From Dr. Grimmius's account, the acid ſhould ſeem to be of the vitriolic kind, but I believe no ſuch accurate experiments have been made as to aſcertain exactly its nature.

3. and 4. An acid has been got from borax, and another acid from amber, both of which we ſhall conſider when we come to treat of theſe ſubſtances.

5. An acid has been lately got from fluor or ſpar.

6. And from tungſtene, or lapis ponderoſus.

7. And from arſenic.

8. And from an ore of lead, called by Mr. Scheile, molybdœna.

Several acids have likewiſe been got from animal ſubſtances.

1. An acid has been obtained from ants and other inſects, by either putting them into a bottle with water, and ſhaking them till they are dead; or by bruiſing them in a mortar, with water, and then ſtraining the water through a cloth; but when it is got in this way, it is mixed with an oily matter.

This acid when pure, Mr. Malouin ſays, is ſo volatile and ſharp, as to make the eyes water. Dr. Vogel mentions, that it diſſolves the calces of ſeveral metals, and forms elegant cryſtals with thoſe of copper, lead, iron, and zinc; and with the fixt vegetable alkali it forms a neutral ſalt that runs per deliquium in the air; and he ſeems to think it an acid of a peculiar kind, approaching to the vegetable. Sir T. Bergman, in his Treatiſe on Elective Attractions, obſerves that this acid, as well as all thoſe of vegetables, may be totally reſolved into an elaſtic fluid, confiſting partly of aerial acid, and partly of inflammable air.

2. An acid is likewiſe got from blood, which was firſt diſcovered by Monſ. Homberg; it comes over into the receiver along with a volatile alkali, towards the end of the diſtillation; from which it is ſeparated by drawing off the volatile alkali with a gentle heat into a receiver, while the acid remains behind in the retort. It is this acid united to a ſmall portion of iron and of an alkali, that forms the Pruſſian blue; and Mr. Scheile ſays, that it has ſuch a powerful attraction to the iron, that it cannot be ſeparated from it by any other acid.

3. An acid of a particular nature has been obtained by diſtilling animal fat; it was firſt diſcovered by Dr. Seguer, of Gottingen. Sir T. Bergman, in his Treatiſe on Elective Attractions, ſect. 32, ſays, that two pounds of ox ſuet yielded, by diſtillation, $14\frac{1}{8}$ ounces of oil, $10\frac{19}{24}$ ounces of a charcoal, and $7\frac{1}{4}$ ounces of an acid; and that the ſalts formed by this acid united to an alkaline ſalt, are very ſimilar to thoſe

produced by vinegar and the ſame alkaline baſis.

As acids harden oils, is it not probable that the acid of the food and drink we ſwallow, is united with the oily particles of our fluids by the animal proceſs, and forms the fat? And is not this one reaſon why publicans and others, who eat heartily, and drink much malt and other vinous liquors, generally become fat? A gentleman of a ſtrong healthy conſtitution, who uſed to take a great deal of exerciſe, finding himſelf turn too fat and unwieldy; and judging that this proceeded more from the wine which he drank, than from the ſolid food he took, gave over the uſe of all vinous and fermented liquors, and ſoon loſt a good deal of his weight, and became as agile as formerly, though he ate as heartily as ever. Some time after, he again began the uſe of wine; it produced the ſame effect as before, and on leaving it off he became again leaner and more active. In the courſe of ten or twelve years he repeated the experiment more than once, and it was always attended with the ſame effect.

4. Another acid has been got from urine, called by Mr. Haupt, ſal mirabile perlatum, which Sir T. Bergman ſays, in his Treatiſe on Elective Attractions, ſect. 34, is an acid of a particular kind.

5. And an acid has been procured from phoſphorus prepared from urine, called the phoſphoric acid. Bergman, in his Treatiſe on Elective Attractions, ſect. 33, obſerves, that it pervades all the kingdoms of nature, and is eſpecially obtained from the human urine, by collecting the microcoſmic ſalt, and fuſing it in the fire. This microcoſmic ſalt, he obſerves, is a triple ſalt, and always contains both the phoſphoric and the acidum perlatum united with a volatile alkali.

Such are the acids which have been principally examined, though it is probable that there are many more which have not hitherto been obſerved. However, notwithſtanding the great number and great variety which nature ſhould ſeem to afford, yet many chymiſts believe that there is but one primogenial acid; that all the different acids are the ſame, but appear in different forms by being mixed with foreign ſubſtances; and that this original acid is the vitriolic.

This fact can only be proved by our being able to change the different acids into one another, which we have not hitherto been able to effectuate: but the production of an acid in vegetables, which receive their nouriſhment entirely from the bowels of the earth; the production of nitre from putrid animal and vegetable ſubſtances, and the increaſed product of it, by the addition of bodies which contain the vitriolic acid, as well as the production of an ammoniacal ſalt from ſoot, and ſeveral other phænomena, ſhould ſeem to favour this opinion.

SECT. II.

Of the general Medical Virtues and Properties of Acids.

HAVING taken a general view of the properties of the different acids which are uſed in the practice of phyſick, I ſhall next conſider their medical virtues.

Acids, particularly the mineral, in their concentrated ſtate, act as ſtrong cauſtics, when applied to any part of the animal body; but they are ſeldom uſed for this purpoſe on account of their fluidity, except in ſome rare caſes of diſeaſes of the tonſils and other parts, where they have been employed to touch putrid or gangrened parts, and been applied by means of a feather or pencil, whoſe point has been dipt in them, either plain or mixed with honey of roſes, or other ſubſtances, to blunt their too great acrimony.

They are made milder, and their acidity is blunted—1. By being diluted with water; 2. By being mixed with oils; and they are immediately converted into mild neutral ſalts, and their cauſticity is deſtroyed by the mixture of alkaline ſalts. And hence if any of the concentrated acids ſhould by accident fall on the ſkin, the immediate application of alkaline ſalts is the moſt effectual remedy to prevent their doing much miſchief, by eating deep into the fleſh; or if too acid liquors are taken down into the ſtomach, the ſwallowing a ſolution of any of the alkaline ſalts, is the moſt ſpeedy and moſt efficacious antidote.

When acids are ſo diluted as to be examined by the taſte, we immediately diſcover that they ſtimulate the fibres, and are aſtringent, or draw the lips together; and hence when the fleſh of animals is macerated in them for ſome time, they contract and harden the fibres: and hence vinegar or other diluted acids, have been uſed by anatomiſts to unravel the fibres of certain parts of the body, becauſe it does not render them ſo brittle as boiling.

The vitriolic acid united in ſmall quantity with oil or hogs lard, ſo as to blunt its acrimony, has been recommended by ſome practitioners, as a good remedy for embrocating relaxed or ſprained joints, and to be applied to paralytic limbs; but their uſe ought not to be continued long, when found not to be of ſervice, particularly to paralytic parts; as they may do hurt by blunting too much the ſenſations of the nerves, an effect which acids, long applied, are found to have.

The vegetable acid and aceſcent liquors, ſuch as ſtale beer, vinegar, verjuice, &c. are daily employed for the ſame purpoſes, and with good effect; they are likewiſe excellent remedies for diſcuſſing the ſwellings of glands, and of other parts, and for correcting the putridity of gangrened and of mortified parts.

In the mouth, acids properly diluted, gently ſtimulate the veſſels, and increaſe the ſecretion of ſaliva and of mucus, at the ſame time that they correct the tendency of theſe liquors to putreſcency; and hence are ſo grateful to the palate and allay thirſt.

In the ſtomach and inteſtines they produce the ſame effects, and check fermentation, eſpecially the mineral acids ſo diluted as to be taken down with ſafety, or the acetous vegetable acid after the fermentation has been completed; for the aceſcent and acid juices of many fruits, inſtead of checking fermentation, are liable to go into a ſtate of fermentation ſoon after being ſwallowed: from the effects they produce in the ſtomach, they often increaſe the appetite, and remove that ſickneſs and nauſea which is ſo frequent in putrid diſorders; they are ſometimes ſerviceable in flatulent diſorders, eſpecially when joined with ſtimulating aromatics, as the vitriolic acid is, in the elixir vitrioli acidum; and no remedies have been found to be more efficacious than acids, where the bile and other gaſtric liquors are of too animaliſed a nature.

Mixed with the blood they change the too putreſcent fluids into a milder nature, and check the too great rapidity of the putreſcent proceſs,

proceſs; by which means they allay the acrimony which ſtimulated the veſſels, and increaſed the velocity of the blood.

The mild vegetable acid and aceſcent ſubſtances are obſerved to have a much better effect in curing many fevers, and the ſcurvy and other putrid diſorders, than the mineral acids or vinegar which has been completely fermented; owing, probably, to theſe ſubſtances being obliged to undergo a proceſs ſimilar to the acetous fermentation in the veſſels of the animal, before they can be converted into a putrid ſtate; which probably aſſiſts to ſweeten and reſtore the mild nature of the blood, and other animal fluids: and this ſhould ſeem to be the reaſon why ripe fruits, mild aceſcent vegetables, and wines, are ſo efficacious remedies in the cure of many diſeaſes.

Acids have been found to aſſiſt in ſtopping hæmorrhagies, particularly where the blood was thin and acrid; and they have ſometimes acted as ſedatives or medicines for procuring reſt; and certainly in ſuch caſes they muſt have produced their effects by allaying the too great acrimony of the fluids, and leſſening the irritability of the nerves.

And joined with ſugar, honey, and ſquills, they have been given as pectoral reſolvent medicines, and been much preſcribed for coughs and other diſeaſes of the lungs.

The kidneys ſhould ſeem to be the natural paſſages by which acids are diſcharged from the human body; and as they paſs off along with our drink, they ſhould ſeem to ſtimulate the ſecretory veſſels, and to increaſe the diſcharge by urine, as every one muſt have been ſenſible of, after drinking freely of acid liquors. By the aſſiſtance of weak warm liquors, and gently ſtimulating and opiate medicines and bed-clothes, their operation may be directed towards the ſkin, and a free perſpiration or ſweat promoted.

Thus far with regard to the virtues of acids in general; but as each acid is ſuppoſed to have particular qualities, we ſhall conſider each of them ſeparately.

SECT. III.

Medical Virtues and Uſes of the Vitriolic Acid.

THE vitriolic acid is ſeldom kept in the apothecaries ſhops in its concentrated ſtate, on account of its ſtrong cauſtic quality; and in moſt diſpenſatories there has been a formula for diluting it with water, when it has been called by the name of the ſpiritus vitrioli tenuis. In the new pharmacopoeia the college of phyſicians of London have ordered one part of the concentrated vitriolic acid to be mixed with eight parts of diſtilled water, and have called it by the name of the *diluted acid of vitriol*; the doſe of which to an adult may be from half a ſcruple to two ſcruples, mixed with four ounces of barley water, or of any other common beverage, which may be repeated two or three times in the day, or once every third or fourth hour; or two or three ounces of the *tinctura roſarum*, in which three drams of the diluted acid (or one of the ſtrong) is mixed with forty ounces of an infuſion of red roſes, may be given as often. At other times the patient's common drink may be mixed with ſuch a quantity of it as will give it an agreeable tartneſs, and the drink may be taken ad libitum. In the London Pharmacopoeia, four ounces of the concentrated vitriolic acid are ordered to be mixed with ſixteen ounces of the aromatic tincture, and when the fæces have ſubſided, and the tincture has been rendered pure by ſtraining or filtering, it has been called elixir vitrioli acidum; and is another formula in which this acid is often preſcribed; it is commonly given from ten to twenty or thirty drops, mixed with a cup full of water, twice or thrice a day.

This acid has been moſt generally ordered with an intention of correcting the acrimony of the blood, of abating heat, quenching thirſt, and promoting the ſecretion of urine.

Its uſe has been found to be of the greateſt ſervice in the petechial and other putrid fevers; in caſes where the blood is too thin and acrid, and patients are ſubject to hæmorrhagies at the noſe, or from other parts; in caſes where a feveriſh heat is apt to return frequently after continued fevers or agues, or where the ſick are ſubject to too profuſe ſecretions by the ſkin: in ſuch caſes I have frequently ſeen the efficacy of this medicine greatly increaſed, by adminiſtering it in a glaſs of Seltzer, or of Spa water.

The continued internal uſe of this acid has been much recommended for the cure of the itch, and of other cutaneous diſorders, by Dr. Helmich of Berlin, who publiſhed a treatiſe on this ſubject in the year 1762, in which he affirms likewiſe that he has found it of great ſervice in the cure of the dyſentery; but hitherto I have not tried it in any of theſe diſorders.

Dr. Tiſſot alledges, that the vitriolic acid is a much more efficacious remedy for the cure of the ſmall pox than the bark; and the baron Dimſdale orders the following drink to be uſed in the ſame diſorder, as one of the moſt efficacious and cooling remedies we can preſcribe: Take of the weak ſpirit of vitriol four ſcruples, of the dulcified ſpirit of vitriol eight ſcruples, and mix them with a quart of barley water.

SECT. IV.

Of the Medical Virtues of the Nitrous Acid.

THE nitrous acid is generally believed to be too fiery and too ſtimulating to be adminiſtered as an internal remedy; though if properly diluted I do not know whether it would not have nearly the ſame effects as other acids; but although the acid itſelf is but ſeldom ordered, yet the dulcified ſpirit, prepared from it, has been much eſteemed as a powerful diuretic, and often preſcribed for that purpoſe.

We have two metallic ſalts made with this acid, which are both only uſed for external application; theſe are, the *lunar cauſtic*, and the *mercurius corroſivus ruber*.

SECT. V.

Of the Medical Virtues of the Muriatic Acid.

THE muriatic acid, commonly called ſpirit of ſea ſalt, has been uſed in the ſame manner as the other acids; about thirty years ago, it was recommended, to be given the length of 20 drops a day, properly diluted, both as a preventative remedy, and for curing the ſea ſcurvy; but experience has not confirmed its efficacy in this diſorder.

It has been ſaid to affect the lungs and to increaſe a cough more than the other acids; eſpecially where there was inflammation or ſuppuration; but how far this is true, I ſhall not take upon me to determine.

In the diſpenſatory two mercurial ſalts, the *ſublimate corroſive*, and the mild or *dulcified ſublimate*, commonly called calomel, are ordered to be prepared with this acid, and a *tincture* is directed to be drawn from iron with it; but of theſe hereafter.

SECT. VI.

Medical Virtues of Vegetable Acids.

VEGETABLE acids are poſſeſſed of moſt of the virtues attributed to acids in general; and are commonly more or leſs uſed in all acute diſeaſes which quicken the circulation, and raiſe a degree of fever, and increaſe the tendency of the fluids to putrefaction, being the beſt correctors of a putreſcent acrimony in the blood of any remedies we know.

They are not commonly given in determined doſes, but are ordered to be mixed with the drinks of the ſick in ſuch quantity as to give them an agreeable tartneſs; though I have ſometimes in putrid fevers ordered draughts containing an ounce; and ſometimes, though more rarely, two ounces of lemon-juice, or of vinegar, to be given every four, five, or ſix hours, with advantage.

In hectic fevers and in threatening conſumptions, no remedies have been found to be more cooling, and to give more relief than ripe fruits, ſuch as oranges, grapes, ſtrawberries, currants, and other acid and aceſcent fruit, taken freely; and when the fruits themſelves cannot be got, robs and jellies made with them have been found to be excellent ſubſtitutes for them.

Sugar, honey, and vegetable oleaginous ſubſtances blunt the ſharpneſs of acids, and change them into a kind of vegetable acid ſoap, which renders them of a more reſolvent nature; and hence have been frequently joined to them when they have been adminiſtered for coughs, and pulmonary and other obſtructions.

SECT. VII.

Vinegar.

THE ancients had a very great opinion of the virtues of vinegar, and looked upon it as one of the beſt preſervatives of health, in ſo much that every Roman ſoldier had a certain quantity of it given to him daily, to be mixed with his drink.

It is certainly a great corrector of putrid acrimony, and has been much employed in bilious and putrid fevers, in the meaſles and ſmall pox, and other acute diſeaſes, with good effect; and has been much recommended as a very powerful medicine even in the plague itſelf.

It was formerly much uſed as a ſudorific; eſpecially when joined to theriaca and other opiates. Boerhaave ſays, that he knew of no ſudorific which is more powerful or more efficacious than vinegar; and that he had never ſeen any remedy have a better effect in giving relief to weak, languid, or lethargic people, or to thoſe who had fallen into fainting fits, than vinegar applied to the noſe or mouth, or taken down into the ſtomach; that he has ſeen it relieve vomiting, and be of ſervice in convulſive and in hyſterical and hypochondriacal diſorders; and it has been much recommended for removing complaints of the ſtomach and bowels occaſioned by lead or by copper. It uſed to be the baſis of moſt of the remedies propoſed as antidotes againſt poiſons.

SECT. VIII.

Cryſtals of Tartar.

THE cryſtals of tartar are commonly reckoned a ſpecies of the vegetable fermented acid; but, as I formerly obſerved, it is not a pure acid, but a neutraliſed ſalt, over ſaturated with the acid of tartar, and taſtes ſour, and has moſt of the general properties of an acid.

When given from two drams to an ounce, they prove purgative; they are often joined to manna, or to infuſions of ſenna, or to other purgative medicines, in order to quicken their operations, and they are ſometimes adminiſtered by themſelves to open the body.

About thirty years ago an account was

publiſhed in the fourth volume of the Commentaria Academiæ Bononienſis, of the good effects produced by this medicine in the dropſy, when given daily from two drams to an ounce, diſſolved either in aperient decoction or in broth; ſince that time I have given it often in the manner recommended, but ſeldom could prevail with my patients to continue its uſe; they complained of its great ſourneſs, and of its making them ſick. This made me try if it would not ſit eaſier on the ſtomach when given in another form, and I ordered the cryſtals of tartar to be made up into the following electuary, which had the deſired effect. Take of the cryſtals of tartar finely powdered, two ounces; of powdered ginger root and of conſerve of roſes, of each two drams, and of ſyrup of oranges as much as will form them into an electuary; of this electuary I ordered the ſick to take from two to ten drams daily; it in general ſat eaſily on the ſtomach, operated as a purge, and often likewiſe as a diuretic medicine, and was of uſe to a great many dropſical patients; relieving ſome, and removing entirely anaſarcous ſwellings from others.

The cryſtals of tartar are much uſed by the miners in Derbyſhire, for the cure of the colica pictonum; they take it from two drams in powder, to half an ounce, every two or three hours, till it purges them briſkly, when it is ſaid generally to remove their complaints. Mr. Hardwick, apothecary at Kenſington, told me, that the late Dr. James had been called to a patient of his who was very ill of this diſorder, and had been for ſome days under the care of other phyſicians, who had ordered purges, baths, opiates, &c. without giving the patient any relief; that he immediately ordered the cryſtals of tartar to be taken as here recommended; that they began to operate by ſtool in about three hours after taking the firſt doſe, and that before the evening the complaint was entirely removed.

And it has been a common practice in caſes where the blood is over-heated, and in ſlight ſcorbutic, and other eruptive diſorders, for patients to drink for ſome time, every morning, of whey made by throwing a dram or two of cryſtals of tartar into a quart of boiling milk, in ſuch quantity as to keep the body open.

SECT. IX.

Eſſential Salts.

THESE eſſential ſalts, as they are called, which are obtained from the juices of aceſcent fruits and plants, contain a certain portion of earth and of oil of the ſubſtances from which they are got, and therefore are not to be looked upon as pure acids, but as a ſpecies of a half neutraliſed acid ſalt: there are none of them at preſent in our diſpenſatory, nor are they much uſed any where in Great Britain, though they are often preſcribed in foreign countries,

CHAP. IV.

SECT. I.

Of Alkaline Salts.

HAVING taken a general view of acid ſalts, we come next to conſider the alkaline.

Alkalies are ſubſtances of quite a different nature from acids; they have an acrid urinous taſte, turn vegetable blue colours to a green; and unite with the different acids, and form a diſtinct neutral ſalt with each of them.

They are reckoned three in number:

1. The vegetable.—2. The foſſil.—3. And the volatile.

When they are in a mild dry ſtate, or are cryſtalliſed, and are ſeemingly free from all heterogeneous mixture and effervеſce ſtrongly on being mixed with acids, they are then ſaid to be *mild*; but it has been proved by Dr. Black and others, that in this ſtate they may be conſidered in ſome meaſure as neutral ſalts, in which the alkali is ſaturated with fixed air or aerial acid; and that the efferveſcence, which enſues on the addition of acids, is owing to the ſtronger acid diſlodging the weaker or aerial acid; and they have likewiſe proved, that when the alkaline ſalts are rendered pure, by the aerial acid being diſlodged, either by the force of fire, or by burnt limeſtone, or other calcined calcarious earths abſorbing it, they become more acrimonious; and are then ſaid to be *cauſtic.*

Chymiſts have long been divided in their opinions, whether alkaline ſalts be natural bodies, or formed by the force of fire uniting the principles of which they conſiſt in the burning or diſtilling the ſubſtances from which they are got.

The general opinion has been, that they are formed by the force of fire, intimately uniting an earth, an acid, and an inflammable matter together, ſo as to form an alkaline ſalt, theſe being the principles of which theſe ſalts are ſuppoſed to be compoſed. In proof of this hypotheſis, it has been alledged, 1. That the fixt vegetable alkali is produced by burning vegetable ſubſtances which contain the principles fit for forming theſe ſalts; though no veſtige of an alkaline ſalt can be diſcovered in theſe vegetables, in their natural ſtate, before they are ſubjected to the force of fire.—2. That the eſſential ſalts of vegetables, which contain an acid and an earth, on being calcined in a crucible along with charcoal, or other bodies which contain a phlogiſton, yield an alkaline ſalt.—3. That by alternately allowing the vegetable alkali to run per deliquium, and drying it again with heat, it precipitates a quantity of white earth every time that it is diſſolved; ſo that the whole of the ſalt is at laſt reduced to this ſort of earth; while the acid and phlogiſton, the other principles of which it was compoſed, have evaporated, or been diſſipated by the repeated application of heat for drying the ſalts.—4. And that in like manner, the volatile alkali is produced by diſtilling animal ſubſtances, which contain the principles fit for producing it; though no marks of a volatile alkali could be diſcovered in theſe ſubſtances while they were yet freſh.

Some chymiſts, however, have believed that the alkaline ſalts got by burning vegetable ſubſtances, or diſtilling parts of animals, are not produced by the action of the fire, but that they exiſted originally in the ſubſtances from which they are got; that they were generated in the plants by the vegetative proceſs, and that the fire only freed theſe ſalts from the other principles in which they were enveloped; and Meſſrs. Wiegleb, Roſenſtiel, Morveau, and others, have produced the following arguments in ſupport of the truth of this doctrine: 1. That they had not been able to procure an alkaline ſalt by mixing earths, oil and acids together, and ſubjecting them to the ſtrongeſt fire, though they had made repeated trials for that purpoſe.—2. That the cryſtals of tartar, which were formerly believed to have been pure acid ſalts, have been found by late experiments to contain a pure vegetable alkaline ſalt; for if ſome of the acid of vitriol be poured on a portion of theſe cryſtals, a true tartarus vitriolatus may be obtained from this mixture; this alkaline ſalt muſt have primarily exiſted in the tartar, which had never been ſubjected to the influence of fire.—3. That the vegetable alkaline ſalt, when purified, is always of the ſame nature from whatever vegetables it is procured; and that therefore it muſt have been an original principle or body, exiſting in the plants or other vegetables from which it is procured; for had it been produced by art, it would have varied, and we ſhould have had different ſpecies of it, according to the principles which the plants contained.—4. And the neutral ſalts which have been found mixed with the aſhes of plants, a tartarus vitriolatus, a nitre and a ſea ſalt, are likewiſe ſtrong proofs in favour of the original exiſtence of an alkali in vegetables.

I do not know that hitherto we have ſufficient proofs to determine poſitively whether the vegetable alkali be produced by the force of fire, or if it exiſted originally in the ſubſtances from which it is prepared, though I am inclined to favour the former opinion; but this queſtion is not material to our preſent purpoſe, and therefore I ſhall paſs it over without further notice, leaving it to be determined by the labours and experiments of future chymiſts; and ſhall proceed to the examination of the three different kinds of theſe ſalts.

SECT. II.

Of the Vegetable Alkali.

THIS alkali may be got by deflagrating nitre in a red-hot crucible, with the addition of charcoal, or of ſome other body containing a phlogiſton or inflammable matter, or by calcining tartar; but the moſt common way in which it is prepared, is by burning wood, plants, or other vegetable ſubſtances, till they are reduced to aſhes, and then ſeparating the ſalts from the aſhes, by lixiviating them with water; and afterwards evaporating the water by boiling the lixivium in iron pots, and keeping it perpetually ſtirring, till the ſalts are perfectly dry.

That obtained from nitre, is quite free

from earth, and if no more phlogiſton has been uſed than was ſufficient to decompoſe the nitre, it will contain the leaſt phlogiſton of any.

That obtained from tartar, is pretty free from earth, and it is reckoned to be the beſt ſaturated with air, and to contain moſt phlogiſton.

That got by burning vegetables is always more or leſs cauſtic; it is commonly brought to the London market under the name of aſhes, mixed with a quantity of earth and other impurities, and with more or leſs of ſome neutral ſalt, particularly with a tartarus vitriolatus, or ſea ſalt, and ſometimes with nitre; and therefore it is neceſſary to purify it before it is uſed as a medicine, which may be done in the following manner.

Take any quantity you pleaſe of potaſhes, or other impure vegetable alkaline ſalt, put it into a large iron pot, pour double its own weight of boiling diſtilled water over it, and boil them together for a few minutes, till all the alkaline ſalts are diſſolved; then pour the whole into a large ſtone or glazed earthen jar, and let it ſtand for three or four days, till all the earth and other impurities have ſubſided, and pour off and filtre through paper the water in which the ſalt is diſſolved; then evaporate it till there remains about 1½ part of water to one of ſalt, and ſet it by in a cool place for a night, to allow any neutral ſalts, which may ſtill be mixed with it, to cryſtalliſe; next day boil up the lixivium, till the ſalt is quite dry, taking care to keep conſtantly ſtirring it about, to prevent its adhering to the iron pot; and keep it in well-ſtopt veſſels.

This ſalt when pure, is dry, and of a white colour; and if it be expoſed to the air, ſoon attracts moiſture, and runs per deliquium; when pure, it is the ſame from whatever ſubſtance it is got.

1. This vegetable alkali unites with all acids, and forms with each of them a different neutral ſalt.

Alkali.	*Acid.*	*Neutral Salt.*
Vegetable Alkali.	Vitriolic.	Tartarus vitriolatus.
	Nitrous.	Nitre.
	Muriatic.	Digeſtive ſalt.
	Vinegar.	Diuretic ſalt.

Immediately on the mixture of this, or any other alkali, in its mild ſtate with an acid, an effervеſcence enſues; owing to the acid diſlodging the fixed air; which does not happen when the alkali is in a cauſtic ſtate, becauſe the fixed air, or aerial acid, has already been ſeparated from it.

It has a ſtronger affinity to acids than either the foſſil or volatile alkali; and than metals or earths.

2. It mixes with all oils, but can only be ſaid to unite intimately with them, and to render them ſoluble in water in its cauſtic ſtate; hence it is in this ſtate that it is uſed for making ſoap, for cleaning woollen cloth, for bleaching linen; and in medicine, for mixing oils with watery liquors.

The common mild alkali does not diſſolve in alcohol or pure ſpirit, but attracts water if any be mixed with it; hence Boerhaave, Macquer, and other chymiſts have propoſed to rectify alcohol with it; but Monſieur Malouin in his Chymie Medicinale, ſays, that it does not rectify alcohol, or make it ſtronger, and that there is reaſon to believe the ſpirit is in ſome meaſure decompoſed by the addition of this alkali.

In its cauſtic ſtate, it unites with alcohol and forms with it a red tincture, formerly called Van Helmont's tincture of ſalt of tartar, which was uſed both for an external and an internal remedy, though it is now very ſeldom called for.

It may be combined with ſulphur by fuſion, and forms with it what is called the hepar ſulphuris, which is ſoluble in water; but of this hereafter, when we come to treat of ſulphur.

3. It unites with ſome few of the metals and demimetals, ſuch as iron, tin, and zinc; and it corrodes copper, and joins with lead in fuſion. It does not affect gold in its metallic ſtate; but if a ſufficient quantity of it is dropt into a ſolution of gold, in aqua regia, till the acid is ſaturated, and all the gold is precipitated; then if more of the alkali be added, it acts on the precipitated calx, and again diſſolves it.

It is a principal ingredient in moſt of thoſe powders called fluxes, which are mixed with ores, to promote the fuſion of metals.

4. It promotes the fuſion of earths, and with the cryſtalline kind, forms pure tranſparent glaſs.

5. It is ſoluble in an equal part of diſtilled water; and if expoſed to the air, it ſoon attracts moiſture, and runs per deliquium. It generates heat with water, and cold with ice.

Many bodies, Dr. Vogel obſerves, have one property of this alkaline ſalt, but if it is pure, it poſſeſſes them all; the only one which no other body has but itſelf, is that of being converted into a tartarus vitriolatus, on the addition of the vitriolic acid.

This alkali in its mild ſtate, has little effect on vegetable or animal ſubſtances, but in its cauſtic ſtate, it corrodes and deſtroys them; and hence is uſed as a cauſtic for opening abſceſſes, and for deſtroying fungous fleſh, &c.

Monſ. Morveau tells us, that he diſſolved one portion of the mild alkali, and another of the cauſtic in pure water, and digeſted a piece of beef in each of theſe ſolutions;

lutions; that the mild ſoon turned the beef of a white colour, and that it putrefied in about the ſame length of time as if it had been digeſted in pure water; but that the cauſtic ſolution ſoon became of a red colour, and the beef in it was converted into a half tranſparent jelly, in which one could eaſily perceive the ramifications of the ſmalleſt fibre; and after ſome months that it emitted but very little ſmell.

SECT. III.

Of the foſſil Alkali.

THE foſſil, or mineral alkali, called ſo from its being often found native in the earth, is certainly the *natron* or *nitre* of the ancients, and not that ſalt which now goes by the name of nitre.

It is mentioned by many ancient authors, and particularly by Pliny and Tacitus, as a ſubſtance uſed for making glaſs when mixed with ſand, and for other purpoſes; and we learn from the Holy Scriptures, that it was uſed in baths; but the knowledge of it was loſt for a conſiderable time, till it was revived by the Hon. Mr. Boyle; and ſince, by the late Monſ. de Hamel de Monceau, who gave a very accurate account of it, in the Memoirs of the Royal Academy of Sciences of Paris for the year 1736; though little notice was taken of it by chymiſts for a number of years after.

Since that time, many hiſtories have been publiſhed of its being found native in Egypt, near to Smyrna, and in other places of Aſia. In the country of Tripoli in Barbary; on the Pic of Tenerif; in many of the provinces of Hungary; in Ruſſia, and in many other countries of the world.

Hitherto it has not been found native in the weſtern parts of Europe, except in mineral waters and in places near to volcanoes, or to places where they were alledged to have formerly exiſted.

In many places, it is mixed with a great quantity of earth; in others, particularly near to volcanoes, it is commonly more pure; but that brought from the country of Tripoli in Barbary, of which I have given an account in the 61ſt volume of the Philoſophical Tranſactions, Art. 52, is in a cryſtallized form, and the pureſt of any native natron that I have hitherto ſeen; though ſome Ruſſian gentlemen have aſſured me that a ſalt very ſimilar to this, is found near to ſome of the lakes in Ruſſia.

It is the baſis of ſea ſalt, and may be procured from it in two ways; 1. By mixing the nitrous acid with ſea ſalt in a retort (in the proportion, according to Dr. Vogel, of four of the acid to one of the ſalt), and diſtilling off the muriatic acid; when the ſalt remaining will be found to be a cubic nitre, from whence the nitrous acid may be diſcharged by deflagrating with charcoal in a crucible. 2. Or by making a Glauber ſalt, by adding the vitriolic acid to ſea ſalt, and diſtilling off the muriatic acid or ſpirit of ſea-ſalt; and then melting in a crucible, a quantity of this Glauber ſalt with a ſufficient quantity of charcoal or other inflammable matter, to form a hepar ſulphuris;

and as the vitriolic acid has a greater affinity with phlogiſton than with alkaline ſalts, if we diſſolve this hepar ſulphuris in water, and add the vegetable acid, the vitriolic acid united to the phlogiſton will precipitate to the bottom in form of ſulphur, and the foſſil alkali united to the vegetable acid will remain diſſolved in the water, from which the acid may be afterwards ſeparated by the force of fire.

But although this alkali may be ſeparated from ſea ſalt, by way of experiment in either of theſe ways, yet the proceſſes are too expenſive to be practiſed for the uſe of manufacturers; and therefore chymiſts have been labouring, but hitherto without ſucceſs, to diſcover a cheap method of procuring it from ſea ſalt. Could a method be fallen upon, of making a kind of hepar ſulphuris by the addition of phlogiſton or other matter to ſea ſalt, it is generally imagined that the alkali might be ſeparated at a cheap rate.

The greateſt quantity of this alkaline ſalt that is at preſent uſed in this country, is got from the aſhes of the kali and other ſea plants, which have been burnt for that purpoſe, in Spain, and Portugal, and on our own ſea coaſt; and it is ſeparated from the aſhes, and purified nearly in the ſame manner as the vegetable alkali is from the aſhes of other plants.

The pureſt ſort of aſhes, containing this ſalt, goes by the name of ſoda or barilla, and is moſtly imported from foreign countries; the impurer, which commonly goes by the name of kelp, is got from burning the ſea weeds found on the coaſt of England and of Scotland.

Is it not probable that moſt of this ſalt, which is found native near to volcanoes or places where they have been, was originally ſea ſalt, from which its acid has been ſeparated by the force of fire? And may not the native ſalt found in other places, have been likewiſe originally ſea ſalt, whoſe acid has been ſeparated by ſome particular proceſs in the bowels of the earth; or by the ſea ſalt being diſſolved in large quantity in the time of the rainy ſeaſons in hot climates, and the water impregnated with this ſalt collecting in pools or ſmall lakes, which are moſtly dried up by the heat of the ſun when the rains are over; and that the heat of the ſun joined to the putrefaction which ſuch waters undergo when they begin to evaporate, carries off the marine acid, and leaves the alkali to concrete either into cryſtals, or into a powdery dry ſalt? The country of Tripoli in Barbary, where a cryſtallized foſſil alkali is found, abounds with a ſea ſalt in which the alkali ſeems predominant, for it reddens meat that is ſalted in it.

This alkali in many reſpects reſembles the vegetable, but it is much milder, and when one taſtes it, impreſſes a ſenſe of cold on the tongue, as common nitre does. It cryſtallizes much eaſier, and does not run per deliquium when expoſed to the air, but its ſurface becomes dry, powdery, and white, and it loſes its tranſparency. The neutral ſalts made with this alkali and the different acids (except the cubic nitre), keep long, without attracting moiſture from the air ſufficient to diſſolve them; for moſt of the neutral ſalts which I made with vegetable acids, and preſented to the Royal

Society in the year 1767, which is twenty years ago, remain intire, though kept, in the ſame uncovered cups and baſons in which they were made, in a drawer.

It ſhould ſeem to contain more phlogiſton or inflammable matter than the common vegetable alkali, for ſpongy brown paper dipt into a ſolution of it in water, and dried, burns almoſt like match paper prepared by dipping it into a ſolution of nitre.

It liquefies in a very gentle heat, and may be rendered cauſtic in the ſame manner as the vegetable alkali, by depriving it of its fixed air by means of quicklime; and it may be reſtored again to its mild ſtate, by diſſolving it in water and cryſtallizing it.

1. It unites with all acids, but with leſs heat and effervеſcence than the vegetable, and with each of them forms a different ſort of neutral ſalt.

	Acid.		*Neutral ſalt.*
Foſſil alkali, with	Vitriolic acid	forms	Glauber ſalt.
	Nitrous acid		Cubic nitre.
	Marine acid		Sea ſalt.
	Vinegar		A ſalt reſembling Rochelle ſalt.
	Cryſtals of tartar		Rochelle ſalt.
	Sedative ſalt		Borax.

It has a leſs affinity with acids than the vegetable alkali, but a greater than the volatile.

2. Like the vegetable alkali it mixes with oils in its mild ſtate, and when rendered cauſtic forms a ſoap, which is thought to be firmer than that made with the vegetable.

With ſulphur it forms a hepar, in the ſame manner as the vegetable alkali; and it yields a tincture to ſpirit of wine by the aſſiſtance of heat; the ſpirit diſſolves and keeps ſuſpended part of this ſalt while it remains hot, which, however, cryſtallizes when the ſpirit becomes cold.

3. The ſolution of this ſalt does not affect gold, ſilver, or quickſilver; by the aſſiſtance of the open air it penetrates copper and iron; and it affects ſlightly tin and lead. It attacks zinc powerfully, but regulus of antimony and cobalt only ſlightly. And with crude antimony it forms a kermes mineral.

Copper, iron, biſmuth, zinc, antimony, and regulus of cobalt, fuſed with two parts of this alkali, in a crucible placed in a very ſtrong fire, are almoſt intirely diſſolved. But tin, lead, and regulus of antimony, treated in the ſame manner, are only diſſolved in part.

4. With calcarious earths reduced to the ſtate of quicklime, it becomes cauſtic. And with cryſtalline earths it forms glaſs.

5. Mr. Pazmand, in his account of the natron found native in Hungary (publiſhed Vienna in the year 1770), ſays, that if its cryſtals be thrown into water, it occaſions a cold in the time of its ſolution, which is the greater the hotter the water is; but that if water be poured on this ſalt when perfectly dry, it occaſions heat, which is leſs the hotter the water is.

Mr. Pazmand likewiſe obſerves, that if this ſalt be melted with a ſtrong heat, its weight becomes double to that of rain water; and that this ſalt changes the colour of moſt vegetables. It changes the blues to green, the green to yellow, the red to purple, the purple to violet, the yellow to orange, the orange to red, &c.

It acts on animal ſubſtances both in its mild and in its cauſtic ſtate, nearly in the ſame manner as the vegetable, but in a milder degree.

SECT. IV.

Of the Medical Virtues of the two fixed Alkaline Salts.

HITHERTO practitioners have not made ſuch accurate obſervations on the effects of theſe two ſalts on the human body, as to aſcertain the particular virtues of each, and therefore they are commonly imagined to be nearly of the ſame nature, and are ordered indiſcriminately; though as the vegetable ſeems to be much more ſharp and acrid than the foſſil, and the foſſil contains more earth and phlogiſton than it, and each of them produces different neutral ſalts with each of the acids, I am perſuaded that future experience will ſhew, that there is a conſiderable difference in their operation in many caſes.

Both of them unite immediately with acids, and change them into a mild neutral ſalt; hence, if by accident or otherwiſe, any of the ſtrong mineral acids ſhould fall on any part of the human body, and begin to corrode and give pain, the immediate application of the lixivium tartari, or of a ſolution of any of theſe alkaline ſalts in water, or of the ſalts themſelves in powder, will deſtroy their cauſticity, and prevent their doing further miſchief. Or if any of theſe acids ſhould drop on clothes, linen, or other ſubſtances, and alkaline ſalts are immediately applied, they will neutralize the acid, and prevent its further corroſion. Or if any perſon ſhould through miſtake ſwallow any of the mineral acids, or corroſive ſublimate, or any other corroding ſalt which an alkali will decompoſe, the taking down into the ſtomach, ſolutions of the alkaline ſalts, or the ſalts themſelves in proper doſes, are the moſt likely means of affording relief, and of preventing miſchief, if not given too late.

Both the vegetable and the foſſil alkali applied externally in a cauſtic ſtate, firſt irritate and inflame the ſkin, and afterward act as fire, in mortifying and deſtroying it, and therefore have been much uſed by ſurgeons for opening buboes and other abſceſſes, and for eating away proud or fungous fleſh that ſprouts out from ſores; various formulæ of cauſtic alkalies have been employed for theſe purpoſes.

1. The ſtrongeſt and one of the beſt is that made by evaporating a well-prepared ſoap ley in an iron pot, till it is quite dry; and then melting and pouring it upon a ſmooth iron plate, and cutting it into pieces while it is yet ſoft; and putting theſe pieces immediately into well-ſtopt glaſs bottles to be kept for uſe.

2. A milder one, however, is moſt commonly employed by ſurgeons, which is prepared, by boiling down a quantity of ſoap ley to one third, or one fourth part of its original weight, and then adding to it as much freſh quicklime as will reduce it to a hard paſte, taking care to keep it conſtantly ſtirring till it come to that conſiſtence. The cauſtic that is moſtly made, at preſent, at Apothecaries Hall, is prepared

by boiling down four pounds of ſoap ley to one, and then adding to it five pounds and four ounces of freſh quicklime.

3. At St. George's Hoſpital, the cauſtic commonly made uſe of by the ſurgeons of that houſe, is made by adding by degrees, half a pound of freſh quicklime to a pound of lixivium of tartar, put into an iron pot; and then after they have been well mixed by boiling them together, and keeping them conſtantly ſtirring with an iron ſpatula, till they acquire the conſiſtence of a cauſtic.

4. A ſtill milder cauſtic may be made by mixing equal parts of ſoft black ſoap and freſh quicklime, immediately before it is wanted for uſe. In the late London Pharmacopoeia, this preparation was called the mild common cauſtic.

The alkaline ſalts, when much diluted with water, have been uſed as waſhes for removing pimples from the face; but if ſuch waſhes are continued long, they are apt to ſpoil the ſkin.

The ancients often diſſolved natron (the foſſil alkali) in their baths, and eſteemed ſuch baths uſeful for removing itchings of the ſkin, the ſcab, the impetigo, the leproſy, and almoſt all ſorts of cutaneous eruptions; and they employed baths of the ſame kind for promoting ſweat, and for curing various diſorders. They mixed it likewiſe with turpentine, with oils, and with unctuous ſtuffs of various kinds; and rubbed or applied ſuch compoſitions to the ſkin, for removing different complaints, to heal ſores, to ſtrengthen weak or relaxed parts, to deſtroy the poiſon of the bite of a mad dog, and of ſerpents; and they eſteemed it as an antidote againſt many other poiſons. Pliny recommends it as a good remedy for cleanſing the teeth, and reſtoring their colour when they have become black; and many of our modern dentiſts make it an ingredient in the powders which they uſe for the ſame purpoſes.

By experiments made, it has been proved, that alkaline ſalts preſerve dead animal ſubſtances from corruption, from which, ſome practitioners have concluded, that they act as ſtrong antiſeptic remedies when ſwallowed as medicines, and are taken up by the lacteal veſſels, and carried by them into the ſubclavian vein, to be mixed with the blood; but it has been found by experience, that they have quite a different effect; for mixed with the blood, they ſtimulate the veſſels, quicken the circulation, and help to diſſolve it; and I have ſeen a number of inſtances where their continued uſe has rendered the blood of a looſe texture, and tending to the putreſcent, in people who have been under a courſe of ſoap, and the alkaline lixivium, for gravelliſh and calculous complaints. The firſt time I obſerved this effect of theſe ſalts, was in an apothecary, who had put himſelf under a courſe of lime water and ſoap ley, for a pain of his ſide, which he ſuppoſed to be gravelliſh; after he had continued the uſe of theſe medicines for ſeven or eight weeks, he catched a cold, for which he was blooded; and on looking at his blood, he found it of ſuch a looſe texture, and ſeemingly ſo acrid, that he was afraid of continuing the uſe of his lixivial medicines; and therefore laid them aſide for ſome time, till his blood came to be of its natural texture; when he again entered on his former courſe, but in ſome time thereafter, he found that they had produced the ſame effects as before, and he laid them aſide a ſecond time. Since then I have ſeen ſeveral inſtances of the ſame kind: and the late Dr. Huxham, in his Treatiſe on the Malignant Sore Throat, has related a caſe, where the too free uſe of the volatile ſalts brought on a hectic fever, and diſſolved the blood ſo much as to occaſion profuſe hæmorrhagies from the inteſtines, the noſe, and the gums.

The alkaline ſalts promote the ſecretions, particularly by the kidnies; and by the help of warm liquors and bed-clothes, their operation may be directed towards the ſkin.

As they give a briſk ſtimulus to the fibres, change the nature of acids, and render viſcid and oily fluids miſcible with water, they have been employed in caſes of the heartburn, and where an acid is prevalent in the ſtomach and bowels, or where theſe organs have been loaded with viſcid phlegm. And they have been given to aſſiſt the operation of the bile, when it has been too weak and inert, either by themſelves or mixed with purgative or other medicines.

Of late the *foſſil alkali* has been preſcribed either by itſelf, or joined to the bark, or to bitters, for removing ſcrophulous, or other indolent ſwellings; and for reſolving obſtructions of various kinds; and ſometimes I have ſeen it produce very good effects. It has been alledged, that it is a more powerful ſolvent of the human calculus than the vegetable alkali, but upon what authority I know not, as I have not heard of any experiments having been made with it, to aſcertain this fact. It is given in doſes from five grains to a ſcruple, two or three times in the day; and in ſome particular caſes it has been given to double that quantity, or more. It may be taken in any common beverage, or in clear broth, made of lean meat, from which the fat has been ſkimmed off. Or it may be made into pills or boluſſes, mixed with ſome powder of liquorice root, by means of gum arabic mucilage, or conſerve. It has been given for the heartburn, mixed with magneſia and cinnamon in powder; and it may be made up into lozenges with them and gum arabic mucilage, or ſyrup of ginger.

The common *vegetable alkalies* have long been employed as diuretics in dropſies; and many inſtances are related by authors, of dropſical waters having been evacuated by their means; and I have ſeen a number of caſes, particularly of the anaſarca, where the water has been carried off by the uſe of theſe ſalts.

Dr. Sydenham had ſuch an opinion of their efficacy in this diſorder, that he adviſes, when patients are too weak to bear the operation of purgative medicines, to truſt the cure to diuretics; among which he ſays, the lixivial ſalts are the principal and moſt efficacious.

When employed as diuretics, they have been taken from ten grains to half a dram or more for a doſe, two or three times in the day, mixed with ſome of the diſtilled waters and ſyrup, or with broth, or with water gruel, or with two ounces of white wine, in which laſt way it is in part neutralized.

They are often added to infuſions of juniper-berries, broom-tops, horſe-radiſh, muſtard-ſeed, Winter's-bark, and other diuretic and warm medicines, in wine and in beer; in this form they prove powerful diuretics, and formulæ ſimilar to the following have been often uſed.

Infuſion in wine.—Take an ounce of each of the following ingredients; of broom-tops, of horſe-radiſh, and of juniper-berries; bruiſe them in a ſtone or marble mortar, put them into a large wide-mouthed bottle, and add to them an ounce of ſalt of tartar and two quarts of rheniſh wine, and infuſe them for four days, then decant off the wine and filter it through paper, and let the patient take from one to two or three ounces of it, three or four times in the day.

Infuſion in beer.—Take an ounce of canella alba, and as much muſtard-ſeed, and juniper-berries, bruiſe them well in an iron mortar, and add an ounce of purified vegetable alkali, and two quarts of ſtrong beer (porter); infuſe them for four days, and then filter the liquor through paper, and let the patient take a wine glaſs full of it, every fourth or every ſixth hour.

Opium ſometimes increaſes their diuretic powers, and they have been joined to eſſential oils, and to the natural balſams, with good effect.

Dr. Mead, in his Monita Medica, mentions the good effects in the dropſy which followed the taking, at bed-time, a draught which contained thirty drops of the tinctura thebaica, and half a dram of lixivium of tartar. On his recommendation, I have often joined theſe medicines together, and have ſeen the beſt effects produced by their uſe, for they not only procured reſt, but likewiſe promoted the diſcharge by urine. The late Dr. Peter Shaw uſed to recommend the balſam copaivi mixed with the lixivium tartari, in the proportion of half a dram of the balſam to a ſcruple of the lixivium, given in an ounce and a half of any of the ſimple waters, and a dram of ſyrup, as a moſt powerful diuretic.

Ten or twelve grains of this or of the foſſil alkali, have been often joined to ten grains or a ſcruple of gum gamboge, or to half a dram of jalap, or to other purgative medicines, and given either in a ſaline draught, or in two ounces of white wine mixed with five grains of ginger; in order to carry off and correct the effects of acid crudities in the ſtomach and bowels, and to make theſe medicines act by urine as well as by ſtool.

It has likewiſe been much uſed as a remedy for gravelliſh and calculous diſorders. In the year 1740, Mrs. Stephens obtained from parliament the ſum of five thouſand pounds, for the diſcovery of the receipt of medicines containing lime, ſoap, alkaline ſalts, and a variety of other things, which on the evidence produced before parliament, particularly that of the late Dr. Hartley of Bath, were believed to be capable of diſſolving the ſtone, which is frequently generated in the human bladder. At that time the late ingenious Dr. Jurins being afflicted with the ſtone, tried a number of experiments with the ingredients of Mrs. Stephens's medicines, from which he concluded, that their efficacy depended entirely on the alkaline ſalts and lime which they contained; and therefore he began to try what effects a ſoap ley would have on himſelf. At firſt he took only a few drops, but gradually increaſed his doſe till he came to take an ounce, and ſometimes an ounce and a half in a proper vehicle, during the ſpace of twenty-four hours; after ſome time he voided ſome ſmall calculi, and was relieved of the ſymptoms of the ſtone. Dr. Hartley, who likewiſe laboured under this moſt terrible complaint, believing that the efficacy of Mrs. Stephens's medicines depended on the ſoap, the lime, and alkaline ſalts which they contained, ordered a paſte to be prepared for himſelf, made of eight ounces of ſoap, one of oyſter-ſhell lime, a dram of ſalt of tartar, and as much water as formed the whole into a ſoft maſs, of which he took large quantities, and found himſelf greatly relieved, though not cured, for a ſtone was found in his bladder after death.

The evidence of the effect of Mrs. Stephens's medicines, joined to the opinions of theſe two eminent phyſicians, induced great numbers of people labouring under gravelliſh and calculous complaints, to try the effects of theſe medicines. Many found great relief from their uſe; but others, particularly thoſe who were afflicted with the ſtone, had all the ſymptoms of this moſt painful diſtemper aggravated, by the ſalts rendering the blood and the other liquors of the body, particularly the urine, ſharp and acrid, ſo as to irritate and inflame the bladder, which was already in too irritable a ſtate from the conſtant friction of the calculus lodged within it.

As few people afflicted with the ſtone can at once bring themſelves to ſubmit to the operation of lithotomy; and as no other remedy except the alkaline ſalts and lime, has hitherto been alledged to diſſolve the ſtone in the bladder, moſt people labouring under this moſt painful diſorder, wiſh, ſooner or later, to try the effects of theſe medicines; particularly ſince the two celebrated chymiſts, Mr. Scheele and Sir Torbern Bergman, after having made a number of experiments with human calculi, have declared, that theſe concretions are moſtly made up of a particular kind of concrete acid, hitherto unknown, joined to a ſmall portion of animal earth; and that if lime water and the cauſtic alkali had not been already uſed as ſolvents of the ſtone, their experiments would have led them to have recommended them as ſuch, till a more accurate examination of theſe calculi ſhould diſcover other remedies that were more efficacious, and which could be given with greater ſafety.

The ley to be uſed may be made in the following manner,

Take of ſalt of tartar eight ounces.

Of freſh quicklime four ounces.

Of diſtilled water a quart.

Mix them all well together in a large bottle, and let them ſtand for twenty-four hours; then pour off the ley and filter it through paper, and keep it in well-ſtopt phials for uſe. Of this the doſe is from thirty drops to three or four drams, which is to be repeated two or three times in the day.

One of the beſt methods of taking this ley is, to mix the quantity to be uſed in the day with three pints of plain broth, which has been made with the lean part of veal, with all the fat or oily parts ſeparated from it, by putting it when made into a large bowl, and ſkimming them off with a ſpoon when cold; and to drink within an hour a pint of this broth three times in the day,—early in the morning,—at noon,—and in the evening; and to continue the uſe of this medicine for three, four, or more months, and during this courſe to live on ſuch things as leaſt counteract the operation of the medicine: to take for breakfaſt ſome plain broth, ſuch as has been deſcribed, with dry toaſted bread or biſcuit; or a diſh or two of tea or coffee in place of the broth: for dinner, to eat the lean part of plain boiled or roaſted meat, or of fowl, with their own gravy or juice for ſauce; and to eat only of vegetables which contain but little acid, ſuch as potatoes, &c. and to uſe for drink toaſt and water, or water with a very ſmall portion of ſpirit in it; and to take care to abſtain from eating fruit and aceſcent vegetables, fat meat, butter or oil; and from drinking wine, beer, cyder, punch, and in ſhort from taking any thing which is likely to counteract or deſtroy the effects of the ley.

With regard to the uſe of the ſoap ley I ſhall only further obſerve, that I have ſeen a number of people who have taken it both for gravelliſh complaints, and for the ſtone; that many of thoſe who had gravel were relieved, and ſome of them ſeemed to be cured; that ſome few of thoſe who had the confirmed ſtone received conſiderable relief for a time from its uſe; but the complaints afterwards returned, and I do not know that one complete cure was made; though from the accounts given by the late Dr. Whytt of Edinburgh, and others, it ſhould appear that this had ſometimes happened: that in many caſes of ſtone the ley occaſioned pain and irritation, and increaſed the violence of the ſymptoms ſo much, that the patients were obliged to lay it aſide; and that this happened moſt frequently where the bladder ſeemed to have been already diſeaſed from the irritation of the ſtone: that at all times it is adviſable to lay aſide this medicine,

cine, at leaſt for a time, whenever it irritates and occaſions pain, or where there are appearances of its continued uſe having broken down the craſis of the blood.

Inſtead of the ſoap ley the following ſolution of the vegetable alkali, fully ſaturated with fixed air (aerial acid), has been lately recommended as a powerful diſſolvent of the ſtone.

Take two ounces of ſalt of tartar and diſſolve it in two quarts of diſtilled water, and then ſaturate it fully with fixed air; and let the patient take eight ounces of it every eight hours.

Many caſes have been related where this medicine is ſaid to have given relief, or to have made a cure: I have hitherto ſeen but one gentleman who has taken it, and who told me that he had received conſiderable benefit from its uſe: but how far experience will confirm what has been ſaid of its efficacy, is at preſent uncertain.

The ſoap ley has likewiſe been recommended as a ſolvent of bilious calculi, and has ſometimes been of ſervice; but I have ſuſpected that it acted more by diſſolving thick and viſcid humours, and aſſiſting the action of the bile, than by diſſolving the calculi themſelves.

SECT. V.

Of the Volatile Alkali.

THE volatile alkali is not a native but an artificial ſalt, for it is no where to be found in the foſſil kingdom; though ſome traces of it are ſometimes found near to volcanoes, or to places where there are marks of ſubterraneous fire, or where vegetable or animal ſubſtances have lain to corrupt.

Moſt modern chymiſts aſſert, that it is compoſed of the ſame principles as the fixt alkaline ſalts, but more intimately mixed and ſubtiliſed by the addition of a greater quantity of phlogiſton; and as a proof of this they have allodged, that the fixt alkaline ſalts can be changed into the volatile, by the mixture of ſubſtances containing phlogiſton, and the force of fire.

Thus Dr. *Stahl* in his *Fundamenta Chemiæ* tells us, that if any dry fixt alkaline ſalt be well rubbed in a mortar with ſuch a quantity of oil of turpentine, as is ſufficient to make it of the conſiſtence of a pulp, and then it is digeſted for ſome weeks in a cucurbit or retort, and afterwards diſtilled, that we get a volatile alkaline ſalt.

In the Memoirs of the French Royal Academy of Sciences for the year 1717, we are told that Mr. *Geoffroy* having placed in a ſand furnace a large retort, which had a tube riſing from the upper part of its neck, and adapted a large tubulated receiver to it, put into the retort by little and little after it was heated (by means of the upper tube), a powder, compoſed of equal parts of nitre and of charcoal; and on the application of heat there came over into the receiver a liquor highly impregnated with a volatile alkali.

And *Cartheuſer*, in the firſt volume of his Materia Medica, ſays, that if two parts of ſalt of tartar be mixed with one of ſulphur,

phur, and be afterwards diſtilled, they yield a volatile alkaline ſalt and ſpirit.

What is here ſaid explains, in ſome meaſure, the reaſon why putrefaction makes vegetable ſubſtances yield a volatile inſtead of a fixt alkaline ſalt; for putrefaction, which is only the continuation of the fermenting proceſs, mixes more intimately the principles of the fixt alkali, and unites with them a greater quantity of phlogiſton, ſo as to produce a volatile inſtead of a fixt alkaline ſalt.

The principles which form the volatile alkali are united in different ways.

1. By the force of fire; as we ſee happens when the bones and horns of animals, and muſtard ſeed, and ſeveral other vegetable ſubſtances, are diſtilled in cloſe veſſels.

2. By putrefaction. 3. and 4. And by the vegetative and animal proceſſes.

Animal ſubſtances yield a volatile alkali by diſtillation, without becoming putrid; as do likewiſe muſtard ſeed, garlick, ſedum minus, and a number of other vegetables; but putrefaction increaſes the quantity of the product; which ſhews that the animal proceſs produces effects analogous to thoſe of putrefaction, as well as the vegetation of ſome plants.

Boerhaave and *Macquer* have both affirmed, that the vegetative proceſs itſelf produces a volatile alkali; for that the juices got by bruiſing muſtard ſeed and other alcaleſcent vegetables, as they are called, contain a volatile alkali which effervefces with acids; but both *Cartheuſer* and Dr. *Vogel* have denied this fact, and affirmed that they could diſcover no traces of a volatile alkali in theſe juices by any experiments they made.

This alkali emits a very ſenſible pungent ſmell, which affects the noſtrils ſtrongly; it evaporates when expoſed to the air, and it riſes and flies off on the application of heat, from whence it has been called volatile.

There are two ſorts of it in common uſe, which only differ from one another in the degree of their purity.

1. The firſt is got from the diſtillation of animal ſubſtances, ſuch as horns, bones,

&c. which is commonly called harſhorn, from its being ordered to be prepared from the horns of deer, in moſt diſpenſatories. It is prepared by putting pieces of hart's horn, or of bones or horns of other animals, into a large iron pot made for the purpoſe; on which is put an iron or earthen top, ſomewhat reſembling the head of a common ſtill, and a capacious receiver is luted to it; after which a fire is gradually raiſed to a great height, and kept up ſo long as is neceſſary; and when the operation is over, there is found in the receiver, a watery phlegm mixed with a portion of volatile ſalt and empyreumatic oil, a volatile alkaline ſalt and an empyreumatic oil; all which may be rendered pure and fit for uſe by proper proceſſes; the ſalt by ſubliming it repeatedly, after it has been mixed with an equal or double quantity of fixed alkali, or of chalk; the addition of a ſmall quantity of rectified ſpirit of wine to the ſalt, before its ſecond ſublimation, has been alledged to render it ſooner pure.

2. The other ſort called volatile ſal ammoniac, is got from the neutral ſalt, com-

poſed of the muriatic acid and volatile alkali, which commonly goes by the name of ſal ammoniac; by mixing with it either ſome of the mild fixed vegetable alkali, or about double its own weight of chalk, and then putting it into a retort and diſtilling; when the volatile alkali will come over into the receiver; and the muriatic acid will remain behind in the retort, united either with the fixt alkali or the chalk, according to which of them has been employed.

The volatile alkali, when it is in a dry form, is always ſaturated with aerial acid, called fixed air; and is then ſaid to be *mild*, and by ſome late chymiſts to be *aerated*; but when it is deprived of this aerial acid, by being diſtilled with quicklime, which abſorbs the acid, and remains behind with it in the retort, the volatile has been called *cauſtic*, and by ſome late chymiſts *pure*; from its having leſs foreign mixture than before; in which ſtate it always appears in a fluid form; and if any of it become ſolid, it is looked upon as a ſure mark of its having abſorbed a portion of aerial acid, and of its returning to a mild ſtate.

The common or mild volatile alkali may be cryſtallized, but then it is apt to run per deliquium, and therefore it is commonly kept in the form it acquires when it is ſublimed.

1. Both the mild and the cauſtic volatile alkali join with all acids, and both form with them neutral ſalts of the ſame nature, but a diſtinct ſort with each acid. Any of the common acids, added to the *mild*, diſlodges the aerial acid, with which it was before ſaturated, and raiſes an efferveſcence; but no ſuch efferveſcence follows on the addition of an acid to the *cauſtic*, it having been deprived already of its aerial acid, when it was reduced to a cauſtic ſtate.

The neutral ſalts which the volatile alkali forms with the acids in common uſe, are

Alkali.	*Acid.*	*Neutral ſalt.*
Volatile Alkali.	Vitriolic.	Vitriolic ammoniac.
	Nitrous.	Nitrous ammoniac.
	Muriatic.	Muriatic or common ammoniac.
	Diſtilled vinegar.	Vegetable ammoniac, or Spiritus mindereri.

All the neutral ſalts, formed with the volatile alkali and acids, have been called ammoniacal, from the common or muriated ſal ammoniacum, which for a long time, was the only one of this claſs which was known; and had got its name from its being originally found in Lybia, in Africa, near to the temple of Jupiter Ammon.

This alkali has a weaker degree of affinity (attraction) to acids than the fixt alkalies; though a ſtronger than either earths or metals.—When mixed with acids it generates a conſiderable degree of cold; whereas the fixt alkalies generate heat.

2. The volatile alkali diſſolves moſt of the baſer metals, ſuch as copper and iron; and if ſome of it in a liquid form be dropped into any liquor containing copper, it immediately ſtrikes a blue colour; and it diſſolves the calces of ſeveral other metals which are precipitated from their ſolutions.

3. The volatile alkali can hardly be combined with earths, but when earths are employed in its ſublimation, ſome of the earth is often ſublimed along with it.

4. The mild cannot be eaſily united by ſimple trituration, to the expreſſed oils, while they are recent, yet it readily unites with the eſſential oils; and Dr. Vogel ſays, that it condenſes them all, not excepting naphtha, into a conſiſtence like wax; and by being diſtilled with them and vinous ſpirits, it forms the ſpiritus volatilis aromaticus.—But the *cauſtic* unites very readily with the expreſſed oils, and with ſulphur, and renders them ſoluble in water.

5. It diſſolves eaſily in water.

6. And it preſerves dead animal ſubſtances from putrefaction. It was long imagined that the volatile alkali was different, according to what ſubſtance it was prepared from; but later experience has ſhewn that the pure volatile alkali is the ſame, from whatever ſubſtance it is got; and that it is only the mixture of an empyreumatic oil, and of other heterogeneous matter, that makes any difference in theſe ſalts; that got from ſal ammoniac is in general the pureſt.

The volatile alkali has many of the virtues

tues and properties of the fixed, but it does not affect animal ſubſtances, particularly in the cauſtic ſtate, ſo powerfully as they do.

It gives a briſk and ſtrong ſtimulus to the nerves and fibres of living animals, and therefore is often employed, in diſeaſes where the pulſe is low, and the circulation too languid; in low fevers, where the patient is in danger of ſinking, in apoplectic and lethargic diſorders of elderly people of phlegmatic habits, in paralytic caſes, in fainting fits, and in other caſes, where a briſk and ſtimulating remedy is wanted.

It promotes the watery excretions, eſpecially that by the ſkin, when given along with plenty of warm drink, and aſſiſted by bed-clothes; and is often uſed for that purpoſe in rheumatiſms, in the end of fevers, in catarrhs, and other diſeaſes, where we think that a plentiful diaphoreſis or ſweat will be of ſervice; and it ſeems to be principally owing to this quality, that theſe ſalts have acquired the reputation of being efficacious remedies againſt the bad effects of the bites of ſerpents, and of other venemous animals.

It deſtroys the effects of acids, and therefore has been often preſcribed to patients labouring under the heartburn, and other diſeaſes where an acid has been ſuppoſed to be prevalent in the ſtomach or bowels.

The doſe of the volatile alkali commonly ordered, is from five grains to a ſcruple; which is repeated ſo often as may be judged neceſſary. It is ſometimes given in larger doſes: I have frequently ſeen a late ingenious phyſician take in water, large doſes of ſalt of hartſhorn in powder for the heartburn; and his apothecary has aſſured me, that he has often given him two drams for a doſe, which he has ſeen him ſwallow at once in a watery vehicle, without ſeeming to be the leaſt incommoded by it.

The volatile alkali is kept in different forms, and mixed with various medicines in the ſhops.

Both the volatile ſal ammoniac, and the ſalt of hartſhorn, are preſerved in a ſolid form, fully ſaturated with aerial acid.

The watery phlegm impregnated with a volatile ſalt, which comes over into the receiver during the diſtillation of hartſhorn, commonly goes by the name of *ſpirit of hartſhorn*; and it is often in a cauſtic ſtate, and does not effervеſce with acids, owing to quicklime in place of chalk being uſed, to keep down the empyreumatic oil, when it is rediſtilled to purify it.

The volatile ſal ammoniac is generally kept in a fluid cauſtic ſtate, under the name of *ſpiritus ſalis ammoniaci cum calce viva*, and of late of *alkali volatile ammoniacum cauſticum* or *purum*, as well as in a mild fluid form; but whether the being made cauſtic makes any difference in its medical virtues, when taken into the blood, is not yet determined.

It has likewiſe been kept in a fluid form, under the name of *ſpiritus ſalis ammoniaci*. This may be made by ſaturating diſtilled water with the mild volatile ſalt; but it is generally ordered to be prepared, by mixing in a retort, about three parts of the vegetable fixt alkali, with two of the common ſal ammoniac, and eight parts of water, and then diſtilling off one half the quantity of water. If the mild purified vegetable alkali be employed in this proceſs, the volatile liquor will be of the mild kind, and will efferveſce with acids; but if the pot-aſh, or other unpurified vegetable alkali be uſed, it will be more or leſs cauſtic, as the ſalt in theſe aſhes is often in part in a cauſtic ſtate, and the earth with which it is mixed has been partly converted into lime.

When united with ſpirit by diſtillation, in the ſame manner as in the foregoing formula with water, it has been called ſpiritus ſalis ammoniaci *dulcis* or *vinoſus*. And when eſſential oils are diſſolved in this dulcified alkaline ſpirit, either by means of digeſtion, or of diſtillation, it has been called *ſpiritus volatilis aromaticus*, and poſſeſſes the virtues of the volatile ſalt joined to thoſe of the eſſential oils.

A ſpirit made by mixing 24 ounces of the vegetable alkali, 12 of common ſal ammoniac, 4 of aſafœtida, with ſix pints of ſpirit, and diſtilling off five pints, has been called *ſpiritus volatilis fœtidus*; and thought to be an excellent ſtimulating nervous medicine.

A ſcruple of rectified oil of amber, and ten grains of ſoap, diſſolved in highly rectified ſpirit of wine, and mixed with four ounces of the cauſtic ſal ammoniac, has been called *ſpiritus volatilis ſuccinatus.* It has long been known under the name of *eau de luce,* and been eſteemed to be a powerful penetrating remedy, and been much uſed, for ſmelling at, in lowneſs and in fainting fits.

Tinctures have been ordered to be drawn from *bark* in the ſpirit of ſal ammoniac; and from *gum guaiacum*, and *valerian root,* in the ſpiritus volatilis aromaticus, which have been much uſed in low and in paralytic caſes.

CHAP. V.

Of Neutral Salts.

HAVING thus conſidered the different acid and alkaline ſalts, I ſhall next take a view of thoſe formed by their union, which have been called neutral, from their partaking of none of the properties of either the acid or alkali, of which they are compoſed, but others peculiar to themſelves.

If there are no more alkaline ſalts in nature than the three already mentioned, to wit,—1. The Vegetable alkali—2. The foſſil—3. And the volatile. And if there were no more acids than four—1. The vitriolic—2. The nitrous—3. The marine—4. And only one vegetable acid, as was formerly imagined; then the number of neutral ſalts would be confined to twelve, as marked in Dr. Cullen's table, to wit,

Neutral Salts compoſed of	*Alkali* and	*Acid.*
1. Tartarus vitriolatus - -	Vegetable	Vitriolic.
2. Glauber ſalt - - -	Foſſil	
3. Vitriolic ammoniac -	Volatile	
4. Common nitre - - -	Vegetable	Nitrous.
5. Cubic nitre - - - -	Foſſil	
6. Nitrous ammoniac - -	Volatile	
7. Digeſtive ſalt - - -	Vegetable	Marine:
8. Common ſea ſalt - -	Foſſil	
9. Common ſal ammoniac	Volatile	
10. Soluble tartar - - -	Vegetable	Vegetable.
11. Rochelle ſalt - - -	Foſſil	
12. Spiritus mindereri -	Volatile	

But experience has ſhewn that each of the vegetable acids, and of the animal, and of the mineral lately diſcovered, have properties different from each other, and form diſtinct neutral ſalts with each of the three alkalies; ſo that the number of neutral ſalts is infinitely greater than was formerly imagined; but as few of them have hitherto been uſed in medicine, and the virtues of the others are but little known, I ſhall only conſider particularly thoſe which have been long in uſe, which are the twelve mentioned in the above table, and one or two more made with varieties of the vegetable acid.

The neutral ſalts may be made in three ways—1. By mixing to the point of ſaturation the pure acid and alkali of which they are compoſed.—2. By employing mixed ſubſtances containing both of them. 3. Or by adding one of them to a mixt ſubſtance containing the other. Thus the *tartarus vitriolatus* may be prepared by mixing the vitriolic acid and the vegetable alkali, diſſolved in a ſufficient quantity of diſtilled water, to the point of ſaturation, and then evaporating the water ſufficiently to allow the ſalt to cryſtallize. Or it may be prepared by mixing a ſolution of the vitriolic ammoniac in water, with the ſal diureticus; for the vegetable alkali of the diuretic ſalt will unite with the vitriolic acid; and the volatile alkali of the ammoniacal ſalt with the acetous acid of the ſal diureticus; and if the mixed liquor be evaporated with a gentle heat till the weight of water be leſs than ten or twelve times the weight of tartarus vitriolatus, and be then ſet in a cool place, the vitriolated tartar

tar will ſhoot into cryſtals: and the neutral ſalt formed by the vinegar and volatile alkali, will be found to have partly evaporated and partly to have remained diſſolved in the water. Or it may be prepared by pouring a proper quantity of the vitriolic acid upon nitre, which will immediately attach itſelf to its alkaline baſis; and upon diſtillation the nitrous acid will come over into the receiver, and the ſalt which remains behind in the retort on being diſſolved in diſtilled water, evaporated and cryſtallized, will be found to be a tartarus vitriolatus.

The beſt of theſe methods for preparing neutral ſalts is certainly the firſt, or the mixing the pure acid and alkali together till they come to the point of ſaturation, where it can be done at as cheap a rate as by other proceſſes; and where the mineral acids or the cryſtals of tartar are employed, it is neceſſary to mix of diſtilled water, a quantity proportioned to that which is required to diſſolve the neutral ſalt to be prepared.

If it be intended to cryſtallize the ſalt, the liquor after it has come to a perfectly neutral ſtate, by the mixture of a due proportion of the acid and alkali, muſt be evaporated, till a ſaline cruſt or pellicle begins to appear on its ſurface; or till it be reduced to a leſs quantity than is ſufficient to keep the neutral ſalt in a fluid ſtate, when it becomes cold; after which it is to be ſet by, to allow the ſalts to ſhoot into cryſtals. By theſe means, perfectly pure neutral cryſtals will be obtained; for if there ſhould be any little ſuperfluous acid or alkali, it will remain in the liquor, or adhere to the neutral ſalts ſo looſely that it may be eaſily waſhed off.

If it be intended to evaporate the neutral ſalt to dryneſs, or to keep it in a fluid form, great care ought to be taken to reduce it to a perfectly neutral ſtate, by mixing a due proportion of the acid with the alkaline ſalt; and where the ſalt is evaporated to dryneſs, a very gentle heat ought to be uſed, particularly towards the end of the operation, and for that reaſon it is often proper to uſe a water bath.

The ſalts which are commonly kept in a cryſtallized from, are—1. The tartarus vitriolatus. 2. Glauber ſalt. 3. Common nitre. 4. Sea ſalt. 5. And Rochelle ſalt.

The ſalts which are commonly evaporated to dryneſs are thoſe prepared with the vegetable alkali, and the varieties of the vegetable acid; owing to the difficulty of keeping them in a cryſtallized form; though the cryſtallized ſoluble tartar and diuretic ſalt have of late been eſteemed preferable to that which is prepared by evaporating to dryneſs.

The common ſal ammoniac is preſerved for the moſt part in the form in which it is ſublimed.

The vitriolic and nitrous ammoniacs, the cubic nitre, and the digeſtive ſalt, may be prepared and preſerved in a cryſtallized ſtate, but they are ſeldom or never employed for medical purpoſes.

The ſpiritus mindereri or vegetable ammoniac is commonly kept in a fluid form, it being difficult to obtain it ſolid.

Neutral ſalts may be decompoſed, either by the force of fire driving off one of their component principles; or by adding to ſolutions of them in water ſome ſubſtance that has a greater affinity with one of their component parts, than it has to the other; and they are likewiſe in part decompoſed by ſolution and heat; for if they be diſſolved and kept long expoſed to heat, part of their acid often flies off with the water; and hence neutral ſalts ought not to be added to liquors that require heat in their preparation, till the liquors are removed from the fire.

The proper menſtruum for neutral, as well as other ſalts, is water; for although other fluids diſſolve ſome of them, yet that ſeems to depend on thoſe fluids containing water, and their power of ſolution to be in proportion to the quantity of water they contain. Authors have differed very much with reſpect to the quantity of water that it requires to diſſolve a given quantity of each of the neutral, as well as of the alkaline and of the ſolid acid ſalts; which has probably been owing to the following circumſtances; to wit, that the quantity of water required to diſſolve any ſalt muſt be more or leſs according as the ſalt is more or leſs pure, according as it contains more or leſs water, and according to the degree of heat which the water employed for its ſolution has.

In order to aſcertain, as near as poſſible, the quantity of water required to diſſolve a certain quantity of the different ſalts, different parcels of equal weight of each of the ſalts, both cryſtallized and perfectly dry, ought to be procured; and then proper trials made to ſee what quantity of diſtilled water, of a certain determined degree of heat, is requiſite to diſſolve each; and four, five, or more different trials ought to be made with each ſalt, with diſtilled water of different degrees of heat; from a degree or two above the freezing point, to the heat of boiling water; and theſe experiments ought all to be made in a room where the air is kept of the ſame degree of heat, while theſe experiments are performing.

Authors, from not attending to the above circumſtances, have differed very much in the quantity of water they have aſſigned for diſſolving the different ſalts; ſome making

ing it double, in many inſtances, to what others do.

The following table, comprehending not only moſt of the true neutral, but likewiſe many of the other ſalts, is taken from the accounts of authors; and though it may be far from being accurate, yet it gives a general idea of the ſolubility of moſt of the ſalts in common uſe, and may ſerve as a guide to others who wiſh to make further experiments on this ſubject; for in it is marked the quantity of diſtilled water which has been alledged ſufficient to diſſolve an ounce of each of the ſalts mentioned.

TABLE of the *Quantities of diſtilled Water required to diſſolve* different Salts.

An Ounce *requires of diſtilled Water*	Ounces *to diſſolve it.*
Of vegetable alkali - -	1 by Grew, near 2 by Vogel.
Of foſſil alkali - - -	$3\frac{21}{25}$ when cryſtallized, by Hon. H. Cavendiſh.
Of ſal cornu cervi - -	$5\frac{1}{3}$ by Eller.
Of volatile ſal ammoniac.	
Of cryſtals of tartar - -	16 by Eller, more by others, 96 by Grew.
Of eſſential ſalt of ſorrel	48 by Grew.
Of vitriolated tartar - -	$5\frac{1}{3}$ by Vogel and Eller, 16 by others.
Of Glauber ſalt - - -	$2\frac{1}{2}$ by Vogel, $1\frac{6}{8}$ by others.
Of Epſom ſalt - - -	1 by Vogel, 2 by Eller.
Of vitriolic ammoniac.	
Of common nitre - - -	2 by Vogel and Eller, $2\frac{20}{27}$ by Grew, 6 by Lewis.
Of cubic nitre - - -	6 by ſome.
Of nitrous ammoniac.	
Of digeſtive ſalt - - -	3 by ſome.
Of ſea ſalt - - - - -	$3\frac{1}{7}$ by Boerhaave, $2\frac{2}{7}$ by Eller, $2\frac{10}{19}$ by Grew.
Of common ammoniac -	$3\frac{1}{4}$ by Boerhaave, $2\frac{14}{17}$ by Grew, $3\frac{1}{15}$ by Vogel.
Of ſoluble tartar - - -	2 by Eller.
Of diuretic ſalt - - -	1 by Grew.
Of Rochelle ſalt - - -	$2\frac{2}{3}$ by Vogel.
Of vegetable ammoniac -	kept moſtly in a fluid ſtate, under the name of ſpiritus mindereri.
Of borax - - - - -	$11\frac{3}{8}$ by Vogel, $14\frac{10}{13}$ by Eller, $13\frac{5}{7}$ by Grew.
Of alum - - - - -	$3\frac{1}{5}$ by Vogel, $3\frac{1}{5}$ by Eller, $6\frac{5}{7}$ by Grew.
Of green vitriol - - -	$1\frac{7}{9}$ by Grew, 7 dr. 10 gr. by Vogel, 6 dr. 2 ſcrup. by Eller.
Of blue vitriol - - -	7 dr. 10 gr. by Vogel, 7 dr. by Eller.
Of white vitriol - - -	$2\frac{3}{7}$ by Vogel, 1 and above $\frac{6}{8}$ by Eller.

Water not only diſſolves a certain quantity of one ſalt, but after it is fully ſaturated with it, it is ſtill capable of diſſolving a certain quantity of another; and when it can bear no more of either of theſe, it will ſtill take up a third, without letting go any of the former two.

Dr. Grew, in his Anatomy of Plants, gives two inſtances of this; and Mr. Eller, in the Memoirs of the Royal Academy at Berlin, for the year 1750 (publiſhed in 1752), has given a number of experiments of this kind. And he found that eight ounces of diſtilled water, ſaturated

With an ounce and a half of volatile ſalt of hartſhorn, diſſolved an ounce of nitre, and half an ounce of ſugar.

With half an ounce of cream of tartar, diſſolved half an ounce of Sedlitz ſalt, and as much fixed alkali.

With an ounce and a half of vitriolated tartar, diſſolved half an ounce of fixed alkali.

With three ounces and a half of Glauber ſalt, diſſolved two drams of nitre, and as much ſugar.

With four ounces of Epſom ſalt, diſſolved half an ounce of refined ſugar.

With two ounces, ſeven drams, and a ſcruple of nitre, Dr. Grew ſays, diſſolved five drams of ſal ammoniac.

With four ounces of nitre, diſſolved one ounce, five drams of fixed alkaline ſalt, and half an ounce of common ſalt.

With three ounces, one dram, and a ſcruple of common ſalt, diſſolved three drams of nitre, and five drams of fixed alkaline ſalt.

With three ounces, one dram, and a ſcruple of ſea ſalt, Dr. Grew ſays, diſſolved five drams of nitre, and one of ſal ammoniac.

With two ounces and a half of ſal ammoniac, diſſolved five drams of foſſil ſalt.

With four ounces of ſoluble tartar, diſſolved half an ounce of purified nitre.

With four drams, two ſcruples of borax, diſſolved half an ounce of fixed alkaline ſalt.

With two ounces and a half of alum, diſſolved ſix drams of common ſalt, and one dram of Epſom ſalt.

With nine ounces and a half of green vitriol, diſſolved an ounce and a half of Sedlitz ſalt, two drams of nitre, and three drams of refined ſugar.

With nine ounces of blue vitriol, diſſolved an ounce of nitre, three drams of common ſalt, and an ounce of ſugar.

With four ounces and a half of white vitriol, diſſolved one ounce of refined ſugar.

From theſe experiments it is demonſtrated, that water ſaturated with one ſort of ſalt is ſtill capable of diſſolving a certain portion of another, and then afterwards of a third, and probably of a fourth, or of a fifth, or more; but how far this may go, has not yet been determined by chymiſts. Do not theſe experiments tend to prove the truth of the concluſion drawn by Dr. Grew,—" That not only the viſible " cryſtals, but the very atoms of every " ſalt, at leaſt thoſe particles which are " ultimately diſſolved in water, have a dif-" ferent figure from one another; becauſe " if they were all of one figure, there " would be no ſuperimpregnation, but " the pores of the ſame water would im-" bibe as much of one ſalt as anſwered

“ to the total of the two or more ſalts “ imbibed.”

No ſolution of ſalts is made without a generation of heat or of cold, which laſts only till the water is intimately united with the ſalts; immediately after which, the watery ſolution returns to the temperature of the atmoſphere. The neutral ſalts, in general, generate cold.

Salts which generate Heat during the Time of their Solution.

The following ſalts generate heat on their mixture with water, and raiſe the quickſilver in Fahrenheit's thermometer as follows.

Dr. Boerhaave mentions, that,

One ounce of vitriolic acid, on being mixed with three of water, raiſed the quickſilver from	45 to 60
——— of dry ſalt of tartar with three of water, raiſed it from	47 to 57

Mr. Eller, that

One ounce of fixed alkaline ſalts diſſolved in diſtilled water, raiſed it - - - - - - -	9 degrees

One

One ounce of Glauber ſalt -	9 degrees
———Sedlitz ſalt - - -	9
———white vitriol - - -	$15\frac{3}{4}$
———vitriol dried to whiteneſs	36

Salts which generate Cold.

Boerhaave mentions, that an ounce of the following ſalts in three ounces of water, lowered the thermometer, as follows.

One ounce nitre, three water, lowered it from - - -	47 to 36
———ſea ſalt, three water, from	46 to 43
———ſal ammoniac, three water, from - - - - - -	47 to 28
———borax, three water, from	48 to $45\frac{1}{2}$

Mr. Eller, that during their ſolution,

Volatile ſalts of hartſhorn, lowered the quickſilver - -	$13\frac{1}{2}$ degrees
Vitriolated tartar - - -	$6\frac{3}{4}$
Epſom ſalts - - - - -	$4\frac{1}{2}$
Purified nitre - - - -	18
Sea-ſalt - - - - - -	$4\frac{1}{2}$
Sal ammoniac - - - -	27
Rochelle ſalt - - - -	$15\frac{3}{4}$
Alum - - - - - - -	$5\frac{5}{8}$

Green vitriol - - - -	$3\frac{}{8}$ degrees
Blue vitriol - - - - -	$7\frac{7}{8}$

On ſaturating the flowers (or the acid) of Benjamin with the volatile alkali, I found that the cold generated ſunk the quickſilver from 52 to 46. And that on ſaturating the ſal ſuccini (acid) with the ſame alkali, that the cold ſunk the quickſilver from 52 to 40.

Some of the neutral ſalts melt with a very gentle heat, ſuch as the *Glauber ſalt*, the *common nitre*, the *cubic nitre*, the *nitrous ammoniac*, and the *ſoluble tartar*.

Others require a much ſtronger degree of heat, ſuch as, *ſea ſalt*, *digeſtive ſalt*, *common ſal ammoniac*, and *borax*; but there is one which will not melt in any degree of heat whatever, viz. the *vitriolated tartar*.

Neutral ſalts, as well as others, all preſerve, more or leſs, dead animal ſubſtances from corruption. The late Sir John Pringle tried a number of experiments to aſcertain their different antiſeptic powers. He put two drams of freſh beef into two ounces of ciſtern water, in which he diſſolved ſixty grains of ſea ſalt, and expoſed the phial containing theſe ingredients, to a heat, equal to that of the human blood; the beef remained ſweet for above thirty hours. After trying a number of experiments with the ſame quantity of beef and the ſame quantity of water, but mixed with different ſalts, expoſed to the ſame degree of heat, he gave the following table of the comparative power of ſalts to reſiſt putrefaction; in which he places ſea ſalt at the head as the ſtandard, as being the weakeſt of any of them. This he ſuppoſes equal to unity, and expreſſes the proportional ſtrength of the reſt in higher numbers; and wherever he puts the ſign + (plus) after the number, he means to ſay, that the ſalt is ſtronger by a fraction than the number marked.

His table of the comparative powers of ſalts in reſiſting putrefaction, is as follows.

1.	Sea ſalt	1
2.	Sal gemmæ	1
3.	Tartar vitriolated	2
4.	Spiritus mindereri	2
5.	Tartarus ſolubilis	2
6.	Sal diureticus	2+

7. Crude ſal ammoniac	3
8. Saline mixture	3
9. Nitre	4+
10. Salt of hartſhorn	4+
11. Salt of wormwood	4+
12. Borax	12+
13. Salt of amber	20+
14. Alum	30+

This table is certainly not complete, for moſt of the acids, the foſſil alkali, and many of the neutral ſalts are omitted, however it ſhews that different ſalts have different antiſeptic powers. But with regard to the experiments, it ought to be obſerved, that they were all made with dead animal ſubſtances; and that we cannot conclude from thence, that they will produce the ſame effects when taken into the human body as medicines; variety of circumſtances prevent this, and daily experience proves that they do not. Thus, alkaline ſalts, which are powerful preſervers of dead animal ſubſtances, when taken for any time as medicines, diſſolve the blood, and promote its putrefaction; while ripe fruit, and many mild freſh vegetables which reſiſt but little the putrefaction of meat, are amongſt the ſtrongeſt correctors of a putrid ſtate of the blood in people labouring under the ſcurvy and other putrid diſorders. However, the experiments made by Sir John Pringle and others, joined to accurate obſervations on the antiſeptic powers of different medicines on living human ſubjects, may certainly have their uſe.

Having premiſed theſe few things relative to the general properties of neutral ſalts, I ſhall next juſt mention their general medicinal virtues, and then treat of each of them ſeparately.

1. The *vitriolated tartar* and *Glauber ſalt* are both of a laxative nature, and have been moſtly uſed for keeping the body open; and the *vitriolic ammoniac* has not been ſo much uſed in practice as to aſcertain its virtues.

2. The *common nitre* is the only one of the three made with the nitrous acid, which has hitherto been employed medicinally in this country; it is eſteemed to be of a cooling nature; it heightens the colour of the

blood and preſerves its fluidity. Externally it has been employed as a diſcutient remedy; internally as cooling and deobſtruent, and for promoting the ſecretions.

3. The *digeſtive* and *ſea ſalt*, particularly the latter, has been more uſed for ſeaſoning our food and promoting digeſtion, than as a medicine; though it has been often uſed in embrocations and in baths, and in other external applications. Taken internally in large quantity, it proves laxative. The common *ammoniac ſalt* externally applied has been eſteemed to be powerfully diſcutient; and internally been preſcribed in various diſorders.

4. The ſalts made with the vegetable acids and the fixt alkaline ſalts, in ſmall quantities promote the ſecretions by the kidneys and the ſkin; and in large, by the inteſtines: And that made with the volatile alkali, externally applied, is powerfully diſcutient; and taken internally, promotes the ſecretion by the ſkin, particularly when aſſiſted by the free uſe of warm liquors.

CHAP. VI.

OF

PARTICULAR NEUTRAL SALTS.

SECT. I.

Vitriolated Tartar, Sal Polychreſt, and Sal Prunell.

THE vitriolated tartar, compoſed of the alkaline ſalt prepared from tartar, and the vitriolic acid, has likewiſe been called the *arcanum duplicatum*, and of late *alkali vegetabile vitriolatum*; its cryſtals are of a pyramidal figure, with eight ſides; it is commonly believed to take ſixteen times its own weight of diſtilled water to diſſolve it; though Vogel and Eller eſtimate the quantity only at $5\frac{1}{3}$. It differs from the other neutral ſalts in not being fuſible in the fire, unleſs ſome other body is added to it.

It has no where been found native, though it is got from the aſhes of plants that have been burnt to procure a fixt alkaline ſalt. Moſt of it, that is uſed, is prepared either by mixing the pure acid and alkali together, to the point of ſaturation; or by adding the vitriolic acid to nitre, and diſtilling off the nitrous acid.

It has been reckoned a good medicine for promoting the ſecretions, particularly by the kidneys and the inteſtines; it is given from ten grains, to two or three drams, or more, diſſolved in ſome proper liquor, for a doſe; in ſmall doſes it acts as an aperient and reſolvent; in large, as a laxative medicine. In chronic obſtructions of the viſcera, and in many other diſeaſes, it has been common to order from a ſcruple to a dram or more of this ſalt, to be diſſolved in a large quantity of cow milk whey, or in mineral waters, and to be drank daily for a conſiderable length of time: I have often ſeen it produce good effects when adminiſtered in this manner; it commonly promoted the diſcharge by urine, at the ſame time that it kept the body open.

Sal Polychreſtus, made by deflagrating in a red-hot crucible, equal parts of nitre and of flowers of ſulphur, has got its name from its being believed to be poſſeſſed of many virtues. Upon examination it has been found to be a vitriolated tartar, united to a hepar ſulphuris, and likewiſe ſometimes to a ſmall portion of nitre; for the vitriolic acid in the time of the deflagration, laying hold of part of the alkaline baſis of the nitre, forms a vitriolated tartar with it, while part of the ſulphur uniting with the remainder, forms a hepar ſulphuris; and where the deflagration has not been thoroughly completed, a ſmall portion of the nitre is ſometimes found mixed with it. This compound ſalt was formerly in great repute, and is ſtill much preſcribed, particularly by foreign phyſicians. It is certainly an excellent medicine where a laxative ſulphureous preparation is wanted; and I have often ordered it with good effect.

It has been uſed in the ſame manner as the tartarus vitriolatus, and given from ten grains to a ſcruple or more, two or three times in the day; or from a dram to half an ounce, diſſolved in ſome proper liquor, early in the morning, when it was intended to operate freely by ſtool.

If this ſalt be thrown into boiling water, and the water be filtered through paper and then evaporated, and the ſalt cryſtallized, as ordered in ſome diſpenſatories, it approaches nearer to the tartarus vitriolatus, by being freed of all the looſe ſulphureous parts which adhered to it.

Sal Prunell, made by deflagrating half an ounce of ſulphur in twelve ounces of melted nitre, is a mixed ſalt, compoſed of nitre and a ſmall portion of vitriolated tartar; the acid of the ſulphur having laid hold of part of the alkaline baſis of the nitre, while its phlogiſton was moſtly evaporated by the deflagration. This ſalt was formerly in great repute, from its being believed that the nitre had been greatly purified by the proceſs; at preſent it is ſeldom preſcribed.

SECT. II.

Glauber Salt, Epſom Salt, and Salts of mineral purging Waters.

THE neutral ſalt, compoſed of the mineral alkali and the vitriolic acid, got its name from Dr. Glauber, who firſt diſcovered it; of late it has been called *alkali minerale vitriolatum*, and *natron vitriolatum*.

It may be made by ſaturating the purified mineral alkali or natron, with the vitriolic acid; but the greater quantity of what is now uſed is got by adding a proper quantity of the vitriolic acid to ſea ſalt, put into a retort, which immediately lays hold of its alkaline baſis, and ſets the marine acid free; ſo that on luting a receiver to the retort and diſtilling, the marine acid comes over into the receiver, and the

Glauber ſalt, formed by the union of the vitriolic acid and the foſſil alkali (the baſis of the ſea ſalt) remains behind in the retort, in form of a ſaline maſs; which, on being diſſolved in diſtilled water, and the water filtered through paper, and evaporated till a pellicle begins to appear on its ſurface, and then ſet by in a cool place, ſhoots into beautiful cryſtals. This ſalt has been found native in Hungary, and in other countries which abound with the foſſil alkali; and it has been got by evaporating the mineral waters at Vaccia Madrid in Spain, and at other places.

The cryſtals, which are ſix-ſided priſms reſembling nitre, contain a large quantity of water; they may be reduced by calcination to one-fourth part of their weight, and reſtored again to their cryſtalline form, by adding to them the ſame quantity of water which they had loſt; they diſſolve in about double their own weight of water, and raiſe Fahrenheit's thermometer about nine degrees during the time of their ſolution; if expoſed to the air they become dry, white, and downy on their ſurface;

and they melt eaſily on the fire, flowing almoſt like water.

This ſalt is moſtly uſed as a purgative, and is given from the quantity of half an ounce to an ounce and a half, or more, for a doſe, when diſſolved in a proper quantity of any mild watery liquor. It is frequently conjoined with manna, or other purgative medicines, to quicken their operation; and it has been given in ſmall doſes of a dram or two drams as a diuretic. Dr. Mead has recommended it both as a diuretic and a laxative medicine, where there is a ſuppreſſion of urine in the ſmall pox.

The *Epſom* or bitter purging ſalt, called of late by Chymiſts *magneſia vitriolata*, is compoſed of magneſia and the vitriolic acid. It is a purging ſalt that is uſed for the ſame purpoſes as the Glauber, and it diſſolves in leſs quantity of water than it. This ſalt was originally got by evaporating the purging mineral water at Epſom in the county of Surry, but now almoſt all that is uſed is prepared from the bittern, or liquor which remains after ſea ſalt has been ſeparated from ſea water. By the account given by Mr. Brown in the 32d volume of the Philoſophical Tranſactions, this bittern, after the ſeparation of the ſea ſalt, is conveyed by channels into pits made tight with clay, where it remains for months; and then the Epſom ſalt ſhoots into cryſtals, and the remaining liquor is boiled down till it ſhews a diſpoſition to afford a ſecond cryſtallization, when it is conveyed into wooden coolers lined with lead. After this ſecond cryſtallization has taken place, the remaining liquor is again boiled down, and new cryſtals are formed; after which the liquor which remains becomes ſharp, and yields no more of this ſort of ſalt; but if boiled to dryneſs, it leaves remaining a marine ſalt with a calcarious baſis, which runs readily per deliquium.

Monſ. Monnet and ſome foreign chymical authors have alledged, that it is neceſſary to add the acid of vitriol or ſome other ſubſtance containing it, to the bittern, before it is capable of producing this bitter purging ſalt; and Sir T. Bergman, in his Analyſis of Sea Water, does not mention his having obtained any of this ſalt in the reſiduum. However, both Dr. Speed and Dr. Lucas affirm, that they got this ſalt from ſea water without any ſuch addition. A gentleman, who was lately at Lemington, at my deſire inquired of the manufacturers of this ſalt, whether they added any of the vitriolic acid, or any ſubſtance containing it, to the bittern from which it was prepared; they ſaid that in general they put none, though they owned that they ſometimes did; but they did not mention to him the circumſtances which at times induced them to make that addition.

Both the Glauber and the Epſom ſalts operate mildly; and although they have a nauſeous taſte, it has been obſerved that when they have been diſſolved in ſimple peppermint water, or a ſufficient quantity of this water has been added to their ſolution in plain water, and given by ſpoonfuls or in repeated ſmall doſes, that theſe ſolutions often ſit eaſy on the ſtomach, and operate by ſtool, after other purgative medicines have had no effect. It is remarked likewiſe of theſe ſalts, that a dram or two drams of them diſſolved in a pint or in a quart of water, will often operate more freely by ſtool, than double that quantity diſſolved in three or four ounces of water; which ſeems to be the reaſon why a pint or a quart of ſome mineral waters, which contain not above one or two drams of purging ſalt, ſometimes purge as freely as a doſe of briſk phyſic. No remedies are often more efficacious in the cure of beginning diarrhœas and dyſenteries, and of the colica pictonum, than theſe ſalts, either diluted with a large quantity of water, or ſoftened by the mixture of manna and ſweet oil, and united to a watery menſtruum, by means of a little of the yolk of an egg, and of gum arabic.

Sir Torbern Bergman has ſuppoſed, that all the purging ſalt of mineral waters is vitriolated magneſia; and that theſe ſalts differ from one another only in being more or leſs pure. How far this may be true I ſhall not ſay, having never tried ſufficient experiments with the ſalts of different ſprings, to determine this fact; but as the cryſtals of theſe differ in their figure from one another, and take different quantities of water to diſſolve them, there is reaſon to ſuſpect that the earth, which forms their baſis, may be different in the ſalts of different ſprings.

The *ſalts of the mineral purging waters* are commonly uſed in the ſame manner as the Glauber and the Epſom ſalts; and it is long ſince the purging mineral waters themſelves have been uſed for curing diarrhœas and dyſenteries; for *Fallopius* recommends greatly the uſe of the waters of Salmacidas and Tettucio at Mount Catinum in Piſtorio, for this purpoſe; and *Baccius* ſays, that theſe waters may be looked upon as a remedy ſent from heaven for the cure of the dyſentery; for that he has ſeen many, who were extenuated and exhauſted, and whoſe caſes ſeemed to be quite deſperate, recalled, as one may ſay, to life, by drinking daily, from a pound to three pounds of them.

SECT. III.

Vitriolic Ammoniac.

THIS ſalt, compoſed of the volatile alkali and the vitriolic acid, has of late been called by chymiſts *alkali volatile vitriolatum*; it was firſt taken notice of by Glauber, who aſcribes many virtues and properties to it; but ſufficient trials have not hitherto been made with it, to aſcertain its medical virtues; and therefore it has not as yet got a place in our diſpenſatory.

SECT. IV.

Common Nitre.

THE nitre of the moderns, compoſed of the nitrous acid and the vegetable alkali, was unknown to the ancients; for it is now pretty evident that their nitre or natron was the foſſil alkali.

It is prepared in Europe from certain earths that have been drenched with putrefied vegetable and animal ſubſtances, and laid for many months in alternate ſtrata with potaſhes and quicklime expoſed to the air; and then thrown into water, which, after it has diſſolved the ſalt, is purified, and ſufficiently evaporated to allow the nitre to ſhoot into cryſtals, as was mentioned when I treated of the nitrous acid.

It is got in large quantity by throwing into water certain earths, found in the province of Bengal in the Eaſt Indies, above and below the city of Patna. A gentleman of credit who had been in that country for a number of years, and had often ſeen it prepared, gave me the following account of it: he ſaid, that the earth from which it is got, forms the ſoil of certain wide extended barren plains, where no graſs or other vegetables will grow, ſo that no cattle or animals of any kind can feed on theſe fields; that the earth is ſo highly impregnated with the nitre, that it taſtes of it; and its ſurface is covered with a ſaline cruſt, which looks like a hoar-froſt upon it; that this earth is thrown into great baſons or pools of water, from whence, when the ſluices are opened, the water paſſes through mats into other baſons, till it becomes pretty clear, and then it is boiled up, and the nitre is allowed to cryſtallize.

Dr. Stahl in his Fundamenta Chemiæ ſays, that a nitrous ſalt is found plentifully lodged in the herbaceous parts of a great number of vegetables; particularly of thoſe which grow on the banks of rivulets, ſuch as the brooklime; and alſo of thoſe that ſhoot out of old walls and ſtones, but eſpecially from the mortar with which they are joined together; of this kind is pellitory; and the ſame may be underſtood of certain emollient and deterſive plants, as mercury, ſoap-wort, mug-wort, wormwood, &c. for if theſe plants be firſt infuſed in highly rectified ſpirit of wine, to extract their reſinous and oily ſubſtance as much as poſſible; and the remaining plant be afterwards directly boiled in water, or rather firſt very lightly calcined, it will thus communicate its ſalt to the water, which being duly evaporated and ſet in a cool place, will ſhoot into nitrous cryſtals.

Nitre ſhoots into cryſtals of the form of ſix-ſided priſms, with two of the ſides broader than the others; and if pure they remain dry in the air. It diſſolves in about three times (Dr. Lewis ſays ſix times) its own weight of diſtilled water; and generates cold during the time of its ſolution, ſinking the quickſilver in Fahrenheit's thermometer, by Boerhaave's account, eleven degrees; by Eller's, eighteen; and hence when applied to the tongue it impreſſes a ſenſe of cold; it melts readily in the fire, and if thrown into a red-hot crucible, mixed with any ſubſtance containing phlogiſton, it deflagrates with a bright flame, and conſiderable noiſe, and a great quantity of its acid evaporates.

Nitre preſerves animal ſubſtances from corruption, and, if mixed with the blood, as it comes from a vein, it prevents its coagulating; and hence it has been looked upon as a cooling attenuating medicine, and thought to aſſiſt in preſerving the fluidity of the blood, and in leſſening its momentum in the veſſels, and been much uſed in fevers, in acute rheumatiſms, and in other inflammatory diſorders.

It is commonly given from five to twenty grains for a doſe, diſſolved in an ounce or two of ſome of the ſimple waters, and the doſe repeated frequently through the day; though ſometimes it is given in much larger quantity, from one to two drams or more, diſſolved in barley water, almond emulſion, water gruel, or ſome other mild liquor; in general it ought to be diſſolved in ſome fluid before it is ſwallowed as a medicine, for the cold, which it generates during the time of its ſolution, frequently occaſions ſickneſs and pain in the ſtomach where that precaution has been neglected.

It has been much preſcribed for allaying the pain and heat of urine in the virulent gonorrhœa; but it ſometimes increaſes both, where the urethra is much inflamed; and therefore where it is found to have this effect, it either ought to be laid aſide entirely for the preſent, or given in very ſmall doſes, diſſolved in large quantities of mild mucilaginous or gummous liquors.

It has at times put a ſtop to nauſea and vomiting, that have come on at the acceſs of fever; but in general the neutral ſalts made with the vegetable acids, taken in an efferveſcing ſtate, when their acid and alkali is firſt mixed, anſwer this purpoſe better.

It ſometimes occaſions pain and uneaſineſs at the ſtomach, which the addition of ſome gentle cordial medicine removes; and at the other times a little of ſome of the vegetable acids added to its ſolutions, makes it ſit eaſy.

It does not agree with every conſtitution; it ſometimes debilitates too much. The late Dr. Alſton, of Edinburgh, uſed in his lectures to mention the caſe of a gentleman, a Mr. Archer, who two different times was attacked with a paralytic complaint of his arm, from taking a dram of nitre daily for a head-ach; and he as often recovered by laying aſide the uſe of it; ſuſpecting it to be the cauſe of theſe paralytic attacks, he took no more of this ſalt, and had no return of his diſorder. I have ſeen a number of caſes, where nitre weakened the conſtitution ſo much that its uſe was obliged to be laid aſide.

Small doſes of this ſalt diſſolved in mild watery liquors, generally prove diuretic; but if taken in large quantities of warm liquors, and aſſiſted by bed-clothes, they promote perſpiration and bring out a ſweat. It frequently proves laxative, though it is ſeldom given with this intention, as large doſes of it are apt to produce ſickneſs and uneaſineſs at the ſtomach.

SECT. V.

Cubic Nitre.

CUBIC nitre, called by late chymiſts *alkali minerale nitratum*, is compoſed of the acid of nitre and the mineral alkali. Dr. Vogel ſays, that it agrees with common nitre in its cold taſte, its fuſibility, and inflammability; but it differs from it in precipitating quickſilver from aqua fortis, which he ſays is owing to its containing ſome of the muriatic acid.

Its cryſtals are not exactly cubes; the ſides, which are ſix in number, being always rhomboidal and not ſquares; they diſſolve in nearly the ſame quantity of water, and generate cold during the time of their ſolution, nearly in the ſame manner as thoſe of common nitre.

The medical virtues of the cubic nitre are believed to be the ſame as thoſe of common nitre; but it has not hitherto been ſo much uſed in practice as to aſcertain its medical virtues and properties.

SECT. VI.

Nitrous Ammoniac.

THE *nitrous ammoniac*, called likewiſe *flaming nitre* (nitrum flammans), and of late *alkali volatile nitratum*, is made by ſaturating the volatile alkali with the nitrous acid. It ſhoots into cryſtals reſembling ſomewhat thoſe of Glauber ſalt; which if put into the mouth impreſs on the tongue a ſenſe of a conſiderable degree of cold; if thrown into a red-hot crucible they melt; and they flame, which common nitre does not, which has been looked upon as a certain proof that the volatile alkali contains a phlogiſton: they diſſolve both in rectified ſpirit and in water, and generate a conſiderable degree of cold during the time of their ſolution. Dr. Vogel ſays, that they run per deliquium when expoſed to the air, but they certainly may be preſerved long entire in well-ſtopt bottles; for I have ſome, which I made myſelf above twenty years ago, which ſtill preſerve their figure and tranſparency.

Hitherto this ſalt has not been adopted into any of the pharmacopoeias of Europe, that I know of; neither have its medical virtues been ſufficiently aſcertained, though Dr. Hoffman in the ſecond book of his Obſervationes Phyſico-chymicæ, obſ. 5, which is inſerted in the 4th volume of his

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works, p. 484, has long ago mentioned, that he thought it might prove a good medicine for diſcuſſing internal inflammations, particularly as it may be united with camphor, or the anodyne liquor, and with his volatile bezoardic ſpirit.

SECT. VII.

Digeſtive Salt.

THE ſalt prepared by ſaturating the vegetable alkali with the muriatic acid has been called Sylvius's digeſtive ſalt, and of late *alkali vegetabile muriatum*: it is no where found native, but is always prepared by art: it differs little from ſea ſalt, but in its cryſtals being ſmaller and harder, and its taſte more agreeable. It is not at preſent employed medicinally in this country, ſea ſalt being generally made uſe of, wherever a ſalt of this kind is wanted. Boerhaave ſays, that a dram of this ſalt taken two hours before the fit of an ague is expected, often removes the fever.

SECT. VIII.

Common, or Sea Salt.

THE ſalt formed by the foſſil alkali ſaturated with the muriatic or marine acid, has been called *common*, from its being the ſalt that we have in greateſt quantity, and is in moſt general uſe; *ſea ſalt*, from the great quantity there is of it in ſea water; and of late *alkali minerale muriatum.*

It is found native in mines in England, Poland, Hungary, and in other countries, when it has been called *ſal gem*, and *rock ſalt*; and it is got in large quantity by evaporating the water of the ſea or of ſalt ſprings.

Its cryſtals are ſomewhat cubical, and when pure do not run per deliquium in the air, which they do if they have a mixture of the Epſom ſalt, which often happens, if great care is not taken to ſeparate it. They diſſolve in about three times their own weight of water; and lower Fahrenheit's thermometer above four degrees during the time of their ſolution; and the difference of the quantity of this ſalt which cold and hot water diſſolves, is much leſs than that of moſt other ſalts.

It is generally looked upon as a ſtrong antiſeptic, and has been much uſed for preſerving animal food from corruption; ſo far indeed is true, that if it be uſed in ſufficient quantity it is poſſeſſed of this quality; but the late Sir John Pringle tells us, that although a dram of this ſalt preſerved two drams of freſh beef from corruption for above thirty hours, in a heat equal to that of the human blood, yet that ten or fifteen grains manifeſtly both haſtened and heightened the corruption; and hence he infers, that as it is ſeldom taken beyond this proportion with our aliment, that it is ſubſervient to digeſtion, by ſoftening and reſolving our food, at the ſame time that it further promotes it, by the ſtimulus it gives to the fibres of the ſtomach and inteſtines: taken in large quantity it proves laxative.

It raiſes and increaſes thirſt, and is looked upon rather as a heating than a cooling remedy: when taken up into the blood, it is not changed by the action of our veſſels, but may be got in the ſame ſtate from the urine, as when ſwallowed; but the other neutral ſalts are alledged to have the ſame property, though as yet a ſufficient number of experiments have not been made to aſcertain this fact with regard to them. The late Dr. John Rutherford, profeſſor of medicine in the univerſity of Edinburgh, was of opinion, that ſea ſalt promoted the generation of the calculus in the human body, and in general laid the foundation of it; for that he himſelf was troubled with gravelliſh complaints, and obſerved that if he eat freely of ſalt for a day or two, he was ſure to have a fit of the gravel; but when he abſtained from it, he was free from this complaint; but I fancy that other cauſes muſt concur with this to bring on gravelliſh diſorders; for we do not find that ſea-faring people, who live much on ſalted proviſions, are more ſubject to the ſtone than other men.

It is ſeldom uſed as an internal remedy, though it is ſometimes ordered to be mixed with clyſters, to increaſe their ſtimulus and to make them operate more freely.

In the firſt volume of the Medical Tranſactions publiſhed by the college of phyſicians in London, article 4, there is related a remarkable caſe of a perſon who had laboured for five years under violent complaints of the ſtomach, for which he tried numberleſs remedies recommended by different people, without receiving any benefit; on the contrary he grew daily worſe: at laſt being adviſed by a friend to drink ſalt and water, as he once knew a perſon labouring under the ſame complaints cured by it; he diſſolved two pounds of ſea ſalt in two quarts of water, and drank the whole in leſs time than an hour; ſoon afterwards he became extremely ſick and vomited violently; on the fourth ſtraining he brought up about half a pint of ſmall worms, part aſcarides, and the reſt reſembling thoſe worms called botts, frequently met with in the ſtomachs of horſes; after this the ſalt procured itſelf a paſſage through the inteſtines, which for the fourteen preceding days had been locked up, and gave him five or ſix very copious fetid ſtools, tinged with blood, and diſcharged in them near an equal quantity of the ſame kind of worms as had been vomited up; he then ſlept for two hours, during which time he ſweated profuſely: when he awoke he felt an uneaſineſs in his throat, ſtomach, and bowels, attended with great thirſt, and afterwards with dyſuria and ſtrangury, for which he drank plentifully of diluting liquors, viz. cold water, whey, butter-milk, or whatever he could get, which removed all theſe complaints: three days afterwards he repeated his doſe with like effect; and afterwards, by taking half a pound from time to time, he got well.

But although ſea ſalt is not much uſed as an internal medicine, yet ſea water which contains it, and a ſmall portion of Epſom ſalt, has been much recommended for removing glandular obſtructions, particularly thoſe of a ſcrophulous nature, drank from half a pint to a pint in the day. Dr. Ruſſel, in his Treatiſe on the Uſe of Sea Water, ſays, that after the tenſion of the veſſels and the danger of their being ruptured has been removed by bleeding, and the uſe of nitrous and other cooling medicines, that ſea water is a moſt effectual remedy for reſolving them; and that he has ſeen few morbid tumified glands where pus was not actually formed, which he could not preſerve from it, and afterwards diſperſe; and that when theſe tumours are mollified by the internal uſe of ſea water, the waſhing and bathing them with it haſtens the diſcuſſion.

I have often preſcribed ſea water in the manner recommended by Dr. Ruſſel, and have often found it of conſiderable uſe; but think that the Doctor has rather gone too far in his praiſes of this remedy. Sea bathing, and the occaſional uſe of ſea water, is often of the greateſt uſe in ſtrengthening relaxed ſcrophulous habits; and is of conſiderable ſervice in bracing and ſtrengthening

ing thoſe whoſe conſtitutions have been weakened by fevers and other diſorders, or by warm climates.

SECT. IX.

Common or muriated Sal Ammoniac.

THIS ſalt, compoſed of the muriatic acid and the volatile alkali, is ſaid to have got its name from its having been originally got in the dry ſands of Lybia, near the temple of Jupiter Ammon, over which caravans travel: it is the moſt common of all the ſalts now called ammoniacal, and is the one that is moſt uſed in practice.

It is generally believed to be no where found native, though it has been alledged to have been gathered near to volcanoes, and places where there are ſubterraneous fires, and in dry ſandy parts under the torrid zone.

Moſt of it that was formerly uſed in this country was brought from Egypt and the Levant, and it was believed to be got by ſimply ſubliming the ſoot produced by burning cow-dung; but many late chymiſts ſuſpect that the people who made this ſalt, added the ley left after ſea ſalt had been ſeparated from ſea water, or ſome other ſaline matter containing the muriatic acid, to the dung, before they ſubjected it to ſublimation.

It is now prepared both in England and in Scotland from materials which contain the muriatic acid and the volatile alkali, but the method of preparing it is kept a ſecret.

A gentleman converſant in theſe matters has informed me that it may be prepared at a very cheap rate, by mixing together, in a retort or ſubliming glaſs, a proper quantity of the vitriolic acid and of the volatile alkali, with ſea ſalt, when immediately on mixture the vitriolic acid lays hold of the fixt alkaline ſalt, the baſis of the ſea ſalt; and on the veſſels being put into ſand, and heat applied, the volatile alkali and muriatic acid riſe to the top of the veſſel, and form the ſal ammoniac; while the vitriolic acid and foſſil alkali uniting to form a Glauber ſalt, remain in the bottom of the veſſel in form of a ſaline maſs; which, on being diſſolved in diſtilled water, and the water with the ſalt being filtered and properly evaporated, yields pure cryſtals of Glauber ſalt.

It may likewiſe be prepared by ſaturating the muriatic acid, properly diluted, with the volatile alkali; and then evaporating the water, and cryſtallizing the ſalt. In general it is prepared by ſublimation, and kept in form of the cakes formed in the veſſels in which it was ſublimed; if cryſtallized, it aſſumes the figure of ſmall ſtars with ſix points.

It diſſolves in about three times its own weight of water; and the cold generated during the time of its ſolution ſinks the quickſilver in Fahrenheit's thermometer twenty-ſeven degrees: it is ſoluble in alcohol, and it melts in the fire.

It is a penetrating reſolving ſalt, which promotes the perſpiration and urine; given in repeated ſmall doſes from ſeven or eight grains to a ſcruple, it increaſes the ſecretion by the kidneys; in larger doſes from a ſcruple to a dram, aſſiſted with plenty of weak warm liquors and bed-clothes, it proves ſudorific; in ſtill larger doſes it looſens the belly, and often occaſions ſickneſs and vomiting.

It has been eſteemed by many practitioners as a powerful febrifuge, and been recommended for the cure of the ague, given in doſes of half a dram or more, mixed with cordials and ſome abſorbent powder, about an hour before the paroxyſm was expected to begin. I have frequently ordered it to be taken in this manner, but it ſeldom had the effect of ſtopping the fit; though I have frequently ſeen a dram of this ſalt, added to an ounce of bark, aſſiſt greatly in removing obſtinate intermittent complaints.

Externally applied it has been found to be a moſt excellent diſcutient remedy; and therefore is often mixed with fomentations and poultices applied with an intention of diſcuſſing inflammatory and other ſwellings: and is added to collyria uſed for inflammations of the eye, and mixed with gargles where the tonſils, or uvula, or other parts of the mouth and throat are inflamed.

SECT. X.

Soluble Tartar.

THE neutral ſalt, compoſed of the vegetable alkali and the acid of vinegar or of tartar, has got variety of names.

When made with the fixed alkali and cryſtals of tartar, it has been called *tartarus ſolubilis*; when with the ſalt of tartar and cryſtals of tartar, *tartarus tartariſatus*; when with ſalt of tartar and vinegar, *ſal diureticus*, or *tartarus regeneratus*, or *terra foliata tartari*; and of late, *alkali vegetabile acetatum.*

And the neutral ſalt made with lemon juice and the vegetable alkali, which is a ſalt of the ſame kind that is moſtly uſed in a liquid a liquid form, has been called *ſaline draught*, and of late, *alkali vegetabile limoniatum*.

Theſe ſalts have all been reckoned to be nearly of the ſame nature, but they have not hitherto been ſo accurately examined, nor their effects on the human body ſo attentively obſerved, as to determine their particular virtues and properties, and in what the operation of the one differs from that of the other. They in general diſſolve in from two to three times their own weight of water, and they diſſolve likewiſe in ſpirit.

They are all of a cooling, reſolving, deobſtruent nature, and thought to be of great uſe in keeping the blood fluid, and in diminiſhing its momentum in the veſſels, at the ſame time that they promote the ſecretions by the kidneys and by the ſkin, and likewiſe by the inteſtines if taken in large doſes.

The ſaline draughts, made with from a ſcruple to half a dram of the vegetable alkali, ſaturated with lemon juice, are often given, once in four or in ſix hours, in feveriſh diſorders, with a view of cooling the body and reſolving the febrile matter; and likewiſe of promoting the ſecretion by the kidneys; or of promoting the perſpiration, when aſſiſted with plenty of warm mild liquors, and bed-clothes: given immediately on mixture, while yet in a ſtate of effervеſcence, they often allay ſickneſs and vomiting; but whether they operate by the aerial acid diſtending the ſtomach, or by its effects on the nerves and contents of the ſtomach, I cannot take upon me to determine: and the ſame quantity of the ſaline draught is frequently made uſe of as a vehicle for rhubarb, and of other purgative medicines, as it has been found to quicken their operation, and to make them operate with greater eaſe to the patient.

The neutral ſalt made with vinegar and ſalt of tartar has been ſuppoſed to promote the diſcharge by urine more powerfully than the others, and therefore has been called ſal diureticus, and been employed in repeated doſes of from ten grains to a dram, for promoting this ſecretion; and it has at times been given as a purgative. The late Dr. Fothergill in the Edinburgh

Medical Eſſays, and the late Dr. Lewis in his new Diſpenſatory, both ſay, that they have ſeen two drams of a fixed alkaline ſalt ſaturated with vinegar, give ten or twelve looſe ſtools in hydropic caſes, and at the ſame time promote a plentiful diſcharge by urine, without the leaſt inconvenience to the patient.

The ſoluble tartar and the tartarus tartariſatus are commonly employed as laxatives, in doſes from two drams to half an ounce, either by themſelves or joined to other purgative medicines.

SECT. XI.

Rochelle Salt.

THE ſalt compoſed of the vegetable acid and the foſſil alkali, has not been long known to the world. For ſome years before the year 1730, a purgative ſalt, the compoſition of which was kept a ſecret,

cret, was ſold by a phyſician of the name of Seignette, at Rochelle in France; and in the year 1731 the receipt of its compoſition was publiſhed in the Memoirs of the Academy of Sciences at Paris, when it proved to be a neutral ſalt, made by ſaturating the foſſil alkali with the cryſtals of tartar; it is commonly called *ſel de Seignette*, and *Polychreſt of Rochelle*; and by late chymiſts, *alkali minerale tartariſatum.*

In preparing this ſalt ſome artiſts diſſolve the cryſtals of tartar in boiling diſtilled water, which they ſaturate with the pure mineral alkali, and then filter the liquor, evaporate and cryſtallize: but as it takes a very large quantity of water to diſſolve the cryſtals of tartar, of conſequence it requires that a great quantity of water ſhould be evaporated, in order to cryſtallize the ſalt; and therefore moſt people now diſſolve the pure mineral alkali in eleven or twelve times its own weight of boiling diſtilled water, and then add by little and little the cryſtals of tartar reduced to a fine powder; always allowing the effervescence and ſolution of the cryſtals of tartar, thrown into the water, to be completed before any more is added; after the liquor is fully ſaturated, it ought then to be filtered through paper, and ſufficiently evaporated to allow the Rochelle ſalt to cryſtallize.

The large cryſtals of this ſalt are from half an inch to an inch long, and above half an inch in diameter, with five or ſix ſides of different breadths, and a plain flat ſurface at each end of irregular pentagon or hexagon figure. The cryſtals of this ſalt do not run per deliquium; they diſſolve in leſs than three times their own weight of water, and they lower Fahrenheit's thermometer two or three degrees during the time of their ſolution. It does not diſſolve in alcohol.

In the Paris Pharmacopoeia it is ſaid, that it takes about ſixteen ounces of cryſtals of tartar to ſaturate twenty ounces of the foſſil alkali.

This is a mild pleaſant purging ſalt, and is given from one to two ounces, diſſolved in watery liquors for a doſe. In France it is common to mix this ſalt with mineral waters, when they wiſh to give them a purgative quality.

The taſte, figure, and ſhape of the cryſtals of a ſalt made with the acid of vinegar and the foſſil alkali, reſemble each other ſo much, that there is great reaſon to believe that the acid of tartar and of vinegar approach near to each other, if they are not entirely of the ſame nature.

SECT. XII.

Vegetable Ammoniac, or Spiritus Mindereri.

THIS ſalt, compoſed of the acid of vinegar and the volatile alkali, has generally been called ſpiritus Mindereri, from Dr. Mindererus, who firſt took notice of it, and introduced it into practice.

It is commonly made with diſtilled vinegar and the volatile ſal ammoniac, and it takes about an ounce of the ſalt to ſaturate a quart of the vinegar; though this varies a little according to the ſtrength of the vinegar: it is commonly kept in a fluid form, and it is reckoned to be of a cooling nature, and been much uſed in feveriſh diſorders; in repeated ſmall doſes of half an ounce, it promotes the ſecretion by urine; but in larger or often repeated doſes, aſſiſted with plenty of warm liquors, and bed-clothes, it proves powerfully diaphoretic: it may be given from half an ounce to four ounces for a doſe to an adult.

Externally applied it is a good diſcutient remedy, and is often uſed for that purpoſe.

It may be obtained in a ſolid form by mixing ſoluble tartar with the vitriolic ammoniac, and then ſubjecting them to ſublimation, when the volatile alkali and vegetable acid will riſe and form a ſolid vegetable ammoniac ſalt, but which runs readily per deliquium; and the vegetable alkali and vitriolic acid will remain behind, and form a tartarus vitriolatus.

However, a ſolid vegetable ammoniacal ſalt, which does not run per deliquium, may be got by diſſolving the volatile alkali in about twelve times its own weight of boiling diſtilled water, and ſaturating this ſolution by throwing, by little and little, into it, cryſtals of tartar reduced to a fine powder, till the alkaline ley is completely ſaturated.

SECT. XIII.

Borax.

HAVING finiſhed the account of the common neutral ſalts, I ſhall next treat of borax, which ſeems to be a neutral ſalt compoſed of the foſſil alkali, and a peculiar ſort of acid, called ſedative ſalt.

Very different accounts have been given of this ſubſtance: Dr. Lemery, in his Dictionary of Drugs, had alledged, that it was got from certain mines in Perſia, and in other countries; and that when it was taken out and expoſed to the air, it became greaſy and red on the ſurface, and in that ſtate had been called by the French borax gras (fat borax). Of late Monſ. Bomare, in a new edition of his Dictionary, has given another account of it; he ſays, "That it is prepared in Perſia and in the Mogul country, by pounding a certain fat grey-coloured ſandy ſtone, or earth, and ſteeping it in a ſaponaceous or gelatinous water, which comes from the mountains, or is found in certain deep pools near to copper-mines; that after a certain time this water is taken out and evaporated, and then put into large troughs, or ditches, lined with white potter's earth, and there let ſtand till a white ſaline earthy matter is precipitated, which is taken out, and then the ſame operation repeated with it as had been performed with the original ſandy ſtone or earth; when the tincal or rough borax concretes in the water, in the form in which it is brought to Europe."

Dr. Lewis ſays, "That it comes to England in great maſſes, compoſed partly of large cryſtals, but chiefly of ſmaller ones, partly white and partly green, joined together as it were by a greaſy yellow ſubſtance, intermingled with ſand, ſmall ſtones, and other impurities." It is purified by diſſolving it in boiling water, and then filtering, evaporating, and cryſtallizing; the ſalt ſhoots into ſmall tranſparent cryſtals, but the refiners have a method of making it ſhoot into large ones; which, *Cramer* ſays, differ from the genuine, and may be called adulterated borax.

It melts into glaſs, which is nevertheleſs ſoluble in water; and it diſſolves in about twelve or fourteen times its own weight of water.

It is more uſed for manufactories and other purpoſes than as a medicine; it promotes greatly the fuſion of metals, and is particularly uſeful in ſoldering; and it makes the cryſtalline earths run more readily into glaſs than the fixt alkaline ſalts; and it is employed in the preparation of artificial gems.

The virtues of this medicine have not hitherto been aſcertained; it was formerly much eſteemed as an emmenagogue, and thought to promote delivery; and moſt diſpenſatories contained a *pulvis ad partum*, which is now generally omitted, though borax ſtill retains a place in their liſts of ſimples.

It is found to be a powerful ſolvent of aphthous cruſts which come in the mouths and fauces of children; and in the mouths of adults from fever, purging, and other diſeaſes. Sometimes it is mixed with honey in the proportion of a dram finely powdered to an ounce of the honey, and given frequently in ſmall quantities; and at other times it is diſſolved in water, and uſed by way of a gargle. Dr. Biſſet, in the ſeventh chapter of his Eſſay on the Medical Conſtitution of Great Britain, § 116, ſays, "That in the thruſh peculiar to children, a ſolution of borax in ſpring-water is the moſt powerful diſſolver and deterger of it yet known; and that it will deſtroy the white cruſts in its increaſe, provided it be not very thick; but it always regenerates ſpeedily after, unleſs it be very ſlight; but if the cruſt is very thin, or if the aphthæ are diſtinct, and the diſeaſe is gentle, and extends not beyond the fauces, the borax will make a perfect cure; even in its increaſe, or before it grows yellow or brown, eſpecially if aided with gentle laxatives." It is ſaid to be uſed with great ſucceſs for the ſame purpoſe in the Eaſt Indies.

When it has been uſed as an internal medicine, it has been given from ten grains to half a dram for a doſe.

I already mentioned, that borax is a neutral ſalt, compoſed of the foſſil alkali and a particular ſort of acid called *ſedative*, which was formerly much eſteemed as a medicine.

This acid, called *ſal ſedativus Hombergii*, is got by mixing with borax the pure vitriolic acid, in the proportion of eight parts of borax to three of the acid; for on mixture, the acid unites itſelf with the foſſil alkali of the borax, and ſets the ſedative ſalt free; ſo that it may be ſeparated either by applying heat and ſubliming, or by diluting with a ſufficient quantity of water, evaporating, and cryſtallizing.

1. When it is to be prepared by *ſublimation*, the borax and vitriolic acid, mixed with a weight of diſtilled water equal to that of the acid, are to be put into a wide-necked retort, and after a receiver has been adapted to it, the fire is to be raiſed till the retort becomes red hot, when the ſedative ſalt will riſe into the neck of the retort in a foliated form; but it is ſeldom made pure by this firſt operation, and therefore it muſt be repeated ſeveral times till the ſalt riſes perfectly pure, taking care each time to add, to the ſedative ſalt to be ſublimed, the watery liquor which came over in the preceding operation.

2. When it is prepared by *cryſtallization*, five ounces of borax in powder are to be diſſolved in diſtilled water of a boiling heat; and then three ounces of the vitriolic is to be added to it by little and little, and the liquor is to be evaporated till ſuch time as a pellicle begins to appear on the ſurface; when the fire is to be removed, and the evaporating glaſs raiſed out of the ſand, and then let remain till the whole is cool, that the ſedative ſalt may concrete into

cryſtals, which are to be well waſhed with cold water, and then dried and kept for uſe.

The firſt method by ſublimation is both tedious and troubleſome, and therefore this laſt by cryſtallization is moſtly performed; though it has been alledged, that the ſedative ſalt procured in this manner, is not generally ſo white as that got by the other; but in other reſpects they are entirely of the ſame nature.

It always concretes into a foliated ſhining form; it is a little bitter to the taſte, but does not feel in the leaſt acid, though it blunts and deſtroys the alkaline qualities of the different alkaline ſalts. It can not be diſſolved in water, unleſs the water be of a boiling heat, and then Monſ. Morveau ſays, that a pound of diſtilled water diſſolves only 183 grains (or three drams three grains) of it. It diſſolves, though with difficulty, in ſpirit of wine.

This ſalt has been called ſedative, from its being believed to be of a mild anodyne nature, and to procure reſt; it has been thought to calm the heat of the blood in burning fevers, and to remove delirium. Profeſſor Gaubius, of Leyden, had a great opinion of this medicine, and alledged, that it was a better medicine than opium, in many caſes, particularly in deliria from fever or inflammation; becauſe it procured ſleep by quieting the nerves without heating; its doſe he eſtimated to be about ſeven or eight grains, diſſolved in water; though it has been given to half a dram or more

It has fallen into diſuſe in this country, whether from its not having been found to be poſſeſſed of the virtues attributed to it, or to its never having been fairly tried, I cannot ſay.

CHAP. VII.

SECT. I.

Of Metals, and Metallic Preparations.

METALS are ſubſtances which are neither ſoluble in water, nor inflammable in fire, but which melt by heat, and concrete again, when cold, into the ſame form they had before.

They are divided into true *metals* and *ſemimetals*; thoſe being eſteemed true and perfect *metals*, which are malleable under the hammer; thoſe imperfect, or *ſemimetals*, which are not ſo; though zinc, which is reckoned to be one of them, has ſome ſmall degree of malleability.

SECT.

SECT. II.

Of pure Metals, and their Preparations.

THE pure metals are reckoned ſix in number:—1. Gold, aurum.—2. Silver, argentum.—3. Copper, cuprum or æs.—4. Iron, ferrum.—5. Lead, plumbum.—6. Tin, ſtannum : which have been whimſically called by the chymiſts after the planets—1. Sol.—2. Luna.—3. Venus.—4. Mars.—5. Saturn.—6. Jove or Jupiter. As they are found in the bowels of the earth, they generally are neither pure nor ductile; but conjoined with ſulphur, arſenic, and other ſubſtances, in which form they are called ores. Sometimes gold and ſilver, and at other times, other metals, have been found in a malleable ſtate.

They are ſeparated from their ores by ſubjecting them to a variety of operations; by waſhing the ores clean with water, to ſeparate the earthy and other light extraneous parts from them; by melting them, and ſubjecting them to the force of fire, to evaporate the ſulphur and other volatile parts; by increaſing the heat to ſuch a degree as is capable of reducing to a calx, part of the mixt ſubſtances; by adding to them, while in fuſion, what are called fluxes, or ſubſtances containing phlogiſton, and a ſaline body, which prevents the true metallic part from being reduced to a calx, and in part unite with the heterogeneous matter, and aſſiſt in reducing it to ſcoriæ; by mixing quickſilver with the metallic parts of the finer ores, to form an amalgam with them, and to ſeparate them in that way from extraneous mixture; by diſſolving the metallic parts in ſuch of the acids as are known to be a proper menſtruum for them: and in ſhort, by variety of operations which I ſhall paſs over, as being foreign to my preſent plan, of treating almoſt only of metals ſo far as they are uſeful in phyſic, referring thoſe, who wiſh to be particularly informed of the metallurgic art, to Cramer's Ars Docimaſtica,

cimaſtica, and other books which treat on this ſubject.

The ſpecific gravities of the true metals are to that of water, as follows:

Gold	as	19,636	to	1,000.
Silver	—	10,509	—	1,000.
Copper	—	8,843	—	1,000.
Iron	—	7,810	—	1,000.
Lead	—	11,300	—	1,000.
Tin	—	7,300	—	1,000.

Theſe metals require different degrees of heat to melt them. Dr. Vogel ſays, that *tin* and *lead* melt eaſily before they become red hot; *gold* and *ſilver* ſo ſoon as they become ſo; *copper* not till ſome time after it has been red hot; and *iron* not till after it has been expoſed to an intenſe heat.

And he obſerves, that ſome of them become ſpecifically heavier, and others lighter, by fuſion. Iron becomes heavier, for a ſolid piece of it thrown into a pot of melted iron, ſwims on the top of it; and the ſame thing happens if a piece of the ſemimetal called biſmuth be thrown into a pot full of the ſame metal in fuſion. But *gold*, *ſilver*, *copper*, *lead*, and *tin*, thrown into a pot of their own metals in fuſion, ſink to the bottom.

Metals, by the force of fire, or by being diſſolved in acids, and precipitated from thence by an alkali, or other ſubſtance, that has a greater affinity with the acid than them, are calcined or reduced to the ſtate of an earth-like ſubſtance, called a calx; which has no appearance of the original metal, is heavier than it was in its metallic ſtate, and has no longer any affinity with other metallic bodies, or even with the metal from which it was produced; and acquires properties different from it; but it may be reduced back again to its metallic ſtate, by reſtoring the phlogiſton it has loſt, by the addition of proper fluxes, and other means.

They are all capable of fuſion by heat; are ſoluble in acids, ſome in one acid, ſome in another; and by being fuſed with hepar ſulphuris, moſt of them become ſoluble in water.

SECT. III.

GOLD.

Aurum, called by the Chymiſts, Sol.

GOLD, and ſome preparations made from it, were long believed to be poſſeſſed of great virtues, and to be powerful remedies in many diſorders; but this has been found to be a miſtake, and they are now never uſed as medicines.

Gold is not ſoluble in any of the pure acids; but is eaſily diſſolved in aqua regia, compoſed of three parts of the nitrous acid and one of the muriatic.

Gold leaf was formerly uſed for gilding pills, but is now laid aſide, on account of its expence, and ſilver leaf ſubſtituted in its place. It has been recommended by ſome French ſurgeons, on account of its thinneſs and ſmoothneſs, to be put between the eye and eyelid when inflamed, to prevent their growing together; but I have never ſeen it uſed for this purpoſe.

Aurum Fulminans.

THE *aurum fulminans*, a calx of gold, prepared by precipitating gold from aqua regia, by means of lixivium of tartar, and then waſhing and drying it, was a medicine in great repute, and was believed to be a good diaphoretic in fevers, and a ſtrengthener in epileptic caſes; but its more certain operation, if given in large doſes, is to vomit and to purge, and that ſometimes with great violence; on which account, joined to its not having the deſired effect in the caſes for which it was recommended, it has been laid aſide, and is now only uſed to ſurpriſe people by the exploſion it makes when a ſtrong heat is applied, or it is rubbed ſtrongly in a mortar.

Aurum Potabile.

THE *aurum potabile*, or drinkable gold, as it was called, is made by diſſolving half a dram of fine gold in two ounces of aqua regia; and adding to it an ounce of the oil of roſemary, which, being lighter, ſwims on the ſurface of the aqua regia, and attracts the gold from it, and acquires a yellow colour; after which the oil is ſeparated and mixed with four ounces of rectified ſpirit of wine, and digeſted with it for a month; at the end of which time it is found to have acquired a purple colour, and is kept for uſe. This tincture was long held in great eſteem, and believed to be an excellent cordial and diaphoretic medicine, and to have acquired great virtues from the gold; but upon an accurate examination, it has been found that it contains but a very ſmall pittance of the gold, and that the greater part, if not nearly the whole of it, adheres to the ſides of the phial in which it was digeſted, and therefore that what virtues it poſſeſſes, it acquires from the ſolution of the eſſential oil of roſemary in the rectified ſpirit.

SECT. IV.

SILVER.

Argentum, called by the Chymiſts, Luna.

SILVER is now as little uſed as gold, as a medicine. The only preparation of it, that now remains in moſt diſpenſatories, being the *lunar cauſtic*, of late called *argentum nitratum*; which is made by diſſolving ſilver in the nitrous acid, diluted with an equal quantity of diſtilled water, in the proportion of one of the ſilver to four of the diluted acid; and evaporating the ſolution to dryneſs and then melting it, and caſting it into ſmall rolls, which are to be kept in well-ſtopt bottles for uſe. This cauſtic is uſed for eating down the fungous fleſh of ſores, and for preventing its further growth, or to help to bring a cicatrix upon wounds.

Pilulæ Lunares.

FORMERLY the following *purging pill* was in great repute. It was made by diſſolving ſilver in a diluted nitrous acid, and then evaporating the liquor, and ſetting it for a night in a cool place, to allow the ſilver to ſhoot into cryſtals; which were afterwards diſſolved in diſtilled water, and mixed with a quantity of nitre, equal in weight to that of the ſilver cryſtals, diſſolved likewiſe in water; and then the whole was evaporated to dryneſs, over a very ſlow fire, while it was kept conſtantly ſtirring till no more fumes aroſe. Two grains of this metallic ſalt, rubbed into a fine powder, and made up into pills with ſix grains of ſugar and ten of crumbs of bread, have been ſtrongly recommended by Dr. Boerhaave and Mr. Boyle, as an excellent medicine for carrying off the waters of dropſies; but having at times acted roughly, they are now ſeldom uſed.

SECT. V.

COPPER.

Æs or Cuprum, called by the Chymiſts, Venus.

COPPER is got in this and in moſt other countries of Europe.

It is acted upon by all ſaline ſubſtances, by acids, by alkalies, and by neutral ſalts, and it is even corroded by moiſture.

The copper, in its metallic form, was never uſed as a medicine, though ſome of its preparations formerly were; but had fallen into diſrepute from many inſtances having occurred, of people being attacked with ſickneſs, nauſea, vomiting, violent gripes, coſtiveneſs, and a train of other bad ſymptoms, which ſometimes occaſioned their death; from their victuals being impregnated with verdigreaſe, by having been prepared inadvertently in copper veſſels, from which the tinning had wore off. Theſe inſtances made moſt practitioners, for a long time, very cautious of ordering any of the preparations of copper, as internal remedies; though a few practitioners, more bold than their brethren, ſtill continued to uſe them.

The principal preparations which are uſed either for medicines or external application, are—1. The ærugo æris;—2. The cuprum ammoniacum;—3. And the vitriolum cæruleum.

Ærugo Æris.

1. THE *ærugo æris* is copper corroded by the vegetable acid in a particular manner. It is generally alledged, that thin plates of this metal are laid in alternate ſtrata, with the huſks and ſtalks of grapes which have been impregnated with the fermented vegetable acid; that in a few days they are covered with a fine downy verdigreaſe, which is ſcraped off, and the proceſs again repeated. This preparation is aſtringent and eſcharotic, and been entirely confined to external application. In the late London Pharmacopoeia, it entered as an in-

gredient into the mel Ægyptiacum, which was compoſed of 14 ounces of honey, 7 of vinegar, and 5 of verdigreaſe, and was only uſed as a gentle eſcharotic. And an ounce of it was added to eight of the unguentum baſilicon flavum, and three of olive oil, in order to make that ointment more ſtimulating and eſcharotic, which was called unguentum baſilicon viride. But both theſe preparations are thrown out of the new diſpenſatory.

The verdigreaſe diſſolved in diſtilled vinegar, evaporated and cryſtallized, has been called *diſtilled verdigreaſe.* It is not uſed as a medicine, but is much employed as a paint, on account of its fine green colour.

Cuprum Ammoniacum.

Cuprum ammoniacum. This preparation of copper has been lately introduced into practice as an internal remedy; and the following receipt of it has been publiſhed in the late edition of the Edinburgh Diſpenſatory.

Take of the pureſt blue vitriol two drams, and of the volatile ſal ammoniac three drams, rub them together in a glaſs mortar, till the efferveſcence is over, and they have united into a violet-coloured maſs; which, after wrapping up in ſpungy paper, dry upon a chalk ſtone with a gentle heat, and then put it into a well-ſtopt bottle, and keep it for uſe.

By this proceſs the copper is united to the volatile alkali, and is ſuſpected to retain a very ſmall portion of the vitriolic acid. It has been given in epileptic, convulſive, and ſpaſmodic diſorders: the doſe which is commonly at firſt given, is only a quarter of a grain, which is repeated twice a day; but this quantity has been gradually increaſed till the patient took a grain or more, four, five or more times in the twenty-four hours. A number of hiſtories of caſes have been related by different practitioners, of which many are ſaid to have been cured by this medicine. Hitherto I have neither given it myſelf, nor ſeen it given by other practitioners: it is apt to make ſome people ſick even in very ſmall doſes; and it has ſometimes operated ſo violently as an emetic, as to make cautious practitioners afraid of uſing it as an internal remedy. Dr. Boerhaave, in the ſecond volume of his Chymiſtry, proceſs 189, mentions a tincture made by digeſting filings of copper in water with ſal ammoniac, as a celebrated antiepileptic medicine, of which he recommends a few drops of it to be given in hydromel early in the morning; and tells us that it occaſions a nauſea, evacuates phlegm, gives a ſtimulus to weak ſtomachs, and kills worms; and by theſe means ſometimes cures the cacochymia and epilepſy. And in proceſs 192 he recommends a tincture made with a dram of the filings in eight times the quantity of the volatile ſpirit of ſal ammoniac; and adviſes to begin with giving three drops of this tincture in hydromel, and to increaſe the doſe daily for four days, till the patient takes twenty-four drops, and then to make him continue taking daily this quantity for ſome days afterwards; he ſays, that he once ordered it in a caſe of a confirmed aſcites, and that it acted ſo powerfully as a diuretic, that the urine ran out as from an open pipe, carried off all the dropſical water, and made a complete cure; though afterwards, on trying it with other patients labouring under ſimilar complaints, it produced no ſuch effects.

Vitriolum Cæruleum.

THE *vitriolum cæruleum*, or blue vitriol, is copper diſſolved by the vitriolic acid, evaporated and cryſtallized. It has long been uſed as an eſcharotic for eating down the proud fleſh of ſores; though it is inferior to the lunar cauſtic for this purpoſe; and it has been employed for ſtopping hæmorrhagies, but for a long time it had not been uſed as an internal remedy, in London, or other great cities in Great Britain; ſome few practitioners however, particularly ſurgeons in the army, uſed it, for the cure of agues, and other complaints; giving it in ſmall doſes from a quarter of a grain to a full grain, three, four, or more times in the day. In the year 1785, Dr. James Adair of Bath, who formerly practiſed in the iſland of Antigua in the Weſt Indies, publiſhed, in the Edinburgh Medical Commentaries, an account of his having uſed this preparation of copper in many thouſand of inſtances, and that he is perfectly aſſured of its being a ſafe medicine; and conſiders its virtues to be thoſe of a mild nauſeative, and eccoprotic ſubſtance; which is at the ſame time ſedative and tonic. His common method of uſing it was the following; he diſſolved half a dram of it in a pint and a half of water, and gave of this from a tea-ſpoonful to two table-ſpoonfuls for an emetic or purgative doſe; and repeated it every two or three hours till it produced its effect: it more frequently purged than vomited; if it vomited it commonly operated but once, unleſs the doſe was repeated. In intermittents he gave it alternately (every other day) with other emetics; but if, notwithſtanding, the diſorder ran on, till the patient had a third or a fourth fit, he gave the bark: in ſome obſtinate caſes where the bark failed, he adminiſtered it in the following form with ſucceſs; he cauſed ſix grains of it to be mixed with an ounce of canella alba in powder, and to be made up into eighty pills with ſyrup; of which he gave from three to ſix pills three or four times during the intermiſſion; and it commonly had a good effect, though it failed in the caſe of a quartan in his own family. Some years ago I was informed by ſeveral ſurgeons of regiments, that it was a practice in the army to give the blue vitriol in ſmall doſes, for the cure of intermittents, and that it often had a good effect. In Spring 1785, having two patients under my care in St. George's hoſpital, who had long laboured under obſtinate intermitting complaints, which had not yielded to the bark, bitters, antimonials, mercurials, ſaponaceous reſolving medicines, &c. I reſolved to try the effects of the preparation with the blue vitriol which had been recommended to me by the regimental ſurgeons, which was made up in the following manner; take four grains of the blue vitriol, mix it with thirty-two grains of the extract of the bark, and make it up into ſixteen pills with a little ſyrup, ſo that each pill may contain a quarter of a grain of the vitriolum cæruleum; of theſe pills I directed each of the two patients to take one pill four times a day; by continuing their uſe for a fortnight, the intermitting complaints in both ſtopt; and in ten or twelve days after, they both went out of the hoſpital ſeemingly in good health; ſoon after a gentleman's ſervant came as an out-patient to the hoſpital, to be cured of a very obſtinate tertian ague, which he had had for ſome time; and for which he had ſwallowed a very large quantity of bark, without receiving any benefit; he told me, that after uſing it for ſome time in ſmall doſes, he had taken two or three ounces of it at a time, and had repeated that doſe ſeveral times in the day for a fortnight or more, but all had had no effect in ſtopping his ague. After giving him an emetic and a purgative medicine, I directed him to take one of the blue vitriol pills four times in the day, and to drink a few glaſſes of red port wine daily, as he ſeemed to be languid and low; by continuing this courſe for three weeks, he got free of his ague, and two months afterwards I ſaw him in good health.

All theſe three patients on firſt taking the blue vitriol pills complained that they made them a little ſick, but after a day or two they had no ſuch effect: probably where the ſick are low, it might be of advantage to give ten or twelve grains, or more, of the extract of the bark, and a few grains of powdered ginger with each doſe of the blue vitriol.

Some of the ſurgeons of regiments who have uſed this medicine, have told me, that when they gave it in large doſes it frequently occaſioned ſuch a ſickneſs that they have been obliged to lay it aſide.

Notwithſtanding what I have ſaid of the good effects produced by the preparations of copper, I think that their uſe ought to be confined to obſtinate caſes, and that they ought always to be adminiſtered with the greateſt caution, as we have ſo many well-vouched inſtances of dangerous and troubleſome ſymptoms having been produced by people having for ſome time eat of victuals impregnated with verdigreaſe from their being dreſſed in copper veſſels, where the metal had been corroded, and part of it diſſolved in them.

SECT. VI.

IRON.

Ferrum, called by the Chymiſts, Mars.

IRON is a metal which is diſtinguiſhed from all others by its being attracted by the loadſtone. It is found not only in mines, but in ſtones and earths, and in the aſhes of vegetables.

When it is firſt melted after being ſeparated from its ore, it is called *caſt iron*; in which ſtate it is not malleable; but it is rendered ſo by making it red hot and beating it with hammers, to drive all its particles cloſer together; when in this ſtate it is called *forged iron*; and by adding to it an additional quantity of phlogiſton, and by dipping it when red hot into cold water, it becomes hard and brittle, and is called *ſteel*; but the ſofter it is the more proper it is for medical purpoſes, as it is more eaſily diſſolved by our juices.

Iron diſſolves readily in all acids, and ruſts freely in the air, eſpecially if occaſionally moiſtened with water.

It has been much uſed as a medicine, and when given in ſuch a form as to be acted upon by our juices, it raiſes the pulſe, cauſes nidorous eructations in the ſtomach, and makes the ſtools black.

The general opinion of its effects on the human body is, that it acts as an aperient and aſtringent medicine, which invigorates the whole ſyſtem, and promotes the ſecretions of the fine watery liquors: it is often preſcribed to ſtrengthen the habit after long and tedious diſeaſes; to put a ſtop to the fluor albus and gleets, and other immoderate diſcharges; to remove obſtructions of the menſtrua, as well as to put a ſtop to their immoderate diſcharge. At firſt view it ſhould ſeem abſurd, and contradictory, to order the ſame medicine with an intention of promoting the uterine diſcharge when obſtructed, and at another of ſtopping it when too profuſe; but theſe two complaints frequently proceed from the ſame cauſe, to wit, a laxity of the habit; and whatever ſtrengthens the veſſels at ſuch times, equally promotes the diſcharge when obſtructed, as enables the mouths of the veſſels to contract and to ſtop it when it is too profuſe. Iron and its preparations have likewiſe been found uſeful remedies in ſpaſmodic and nervous diſorders, in caſes of worms, and where the ſtomach and inteſtines are weak and overloaded with viſcid pituit; and in ſhort, where a medicine that invigorates the whole frame is wanted.

It muſt be uſed with caution in ſtrong plethoric habits, and where there is much heat and fever.

Iron is given in various forms, and differently prepared; but the preparations which have been uſed in practice may be divided into the three following claſſes.

Firſt Claſs.

THE firſt comprehends iron in ſubſtance, or where it is only corroded, but not diſſolved by acids: under this head may be brought the four following preparations.

Limaturæ Ferri.

1. THE *limaturæ ferri,* which are the fineſt parts of the filings of iron which have been reduced to a fine powder.

Æthiops Martialis.

2. Dr. Lemery's *æthiops martialis,* or iron reduced to an impalpable black powder, by being kept conſtantly in water for ſome weeks, and every day ſtirred frequently about.

Crocus Martis.

3. THE calces, called *crocus Martis aſtringens,* and *crocus Martis aperiens,* which are iron corroded and reduced to the ſtate of a calx by the force of fire.

Rubigo Ferri.

4. THE *rubigo ferri,* or ruſt of iron which has been corroded with vinegar, and thereby reduced to the ſtate of a brown calx.

All theſe four preparations have the general properties of iron, and are reckoned to be nearly of the ſame nature; the firſt three are at preſent ſeldom uſed, the rubigo ferri ſupplying their place; it being eſteemed the moſt active, from its having been united, more or leſs, with the vegetable acid, and therefore ſuppoſed to be more readily acted upon by our juices.

Second Claſs.

THIS ſecond claſs is made to comprehend all thoſe preparations where the iron is reduced to the form of a ſolid ſalt, with ſome of the acids; or where it is mixed with ſome ſaline ſubſtance in a ſolid form; to this claſs belongs, 1. The *ſal Martis.* 2. *Tartarus martialis.* 3. *Ferrum tartariſatum.* 4. And the *flores Martis.*

Sal Martis.

1. THE *ſal Martis,* or green vitriol, is iron diſſolved in a diluted vitriolic acid, and then evaporated, and the metallic ſalt allowed to cryſtallize. This preparation has been very much uſed, and been given from one grain to five or ſix for a doſe. It is apt to create a nauſea, and ſometimes a vomiting

ing and purging if given in large doſes; and therefore other preparations of iron are often preferred to it. One of the beſt methods of adminiſtering it on many occaſions is, to diſſolve a grain or two grains of it in a pint or a quart of pure water, and to make the patient take it at repeated draughts in the morning.

Tartarus martialis.

2. *TARTARUS martialis*, made by boiling a quarter of a pound of white tartar reduced to a fine powder, and an ounce of filings of iron, in ſix pints of water, till the tartar is diſſolved, and then filtering the liquor, evaporating it, and cryſtallizing the ſalt; by evaporating the water which remains, freſh cryſtals may be obtained.

This is a preparation which has been much uſed among the French phyſicians, and is recommended by Monſ. Malouin, in his Chymie Medicinale, as a moſt excellent chalybeate; he ſays, that the doſe is from ten grains to a dram; but that in common, half a dram diſſolved in ſome apozeme, or in broth, is given at a time.

Mars

Mars Solubilis.

3. A MEDICINE a good deal ſimilar to this laſt, uſed to be kept in the ſhops under the name of *Mars ſolubilis*, and chalybs tartariſatus, and now of *ferrum tartariſatum.* It is made either by mixing equal quantities of filings of iron and of cryſtals of tartar reduced to powder, and making them into a paſte with water, and then baking them in an oven, and repeating the operation till the whole is reduced to an impalpable powder; or by expoſing the paſte after it is made to the open air for a week, and then drying it by a ſand-heat, and reducing it to a fine powder.

This ſhould ſeem to be a preparation intirely of the ſame nature as the preceding one, the tartarus martialis; the only difference being that the one is in a cryſtalline form, the other in that of a fine powder; and that this laſt contains a greater quantity of iron than the former, and may act as a ſtronger chalybeate when taken down into the ſtomach. Both theſe medicines are elegant and uſeful preparations of iron, and Dr. Lewis ſays, will ſometimes take effect, after the other preparations have failed.

Flores Martiales.

4. *FLORES martiales,* martial flowers, formerly called ens Veneris, are only ſal ammoniac impregnated, by means of ſublimation, with ſuch a quantity of iron as gives it a very deep orange colour: I do not know that it has hitherto been aſcertained by chymiſts what is the proportion of iron which this preparation contains.

Theſe flowers may be prepared in the following manner: mix well together one pound of filings of iron, or of colcothar of vitriol (which is the martial vitriol reduced by means of a very intenſe heat to a brown red-coloured matter), with two pounds of crude ſal ammoniac; and then put them into a proper veſſel, and ſublime with a ſtrong and quick raiſed heat: after the operation is over, take out both the matter which has ſublimed, and what has remained in the bottom of the veſſel; grind them well together in a mortar, and ſublime them a ſecond time, that the flowers which ariſe may acquire a beautiful yellow or orange colour; after which keep them for uſe in well-ſtopt bottles.

Different authors have recommended to uſe different proportions of the ſal ammoniac and of the iron, but that does not alter materially the nature of the medicine; and Dr. Lewis obſerves, that iron or earthen veſſels are more proper for performing this proceſs than glaſs; becauſe its ſucceſs depends in a great meaſure on the fire being haſtily raiſed, that the ſal ammoniac may not ſublime before the heat is become ſtrong enough to enable it to carry up the iron in ſufficient quantity; and a ſtrong heat ſo ſuddenly raiſed is in danger of breaking retorts or other veſſels made of glaſs.

This preparation is ſuppoſed to be highly aperient and attenuating, and to poſſeſs the virtues of iron heightened by its intimate union with the ſal ammoniac; and to powerfully promote the perſpiration and the diſcharge by urine. Dr. Boerhaave in his Chymiſtry calls it a wonderfully warming reſtorative medicine, which has an anodyne, and even a ſeminarcotic quality. It has been formerly much uſed in nervous and hyſterical caſes, and in diſeaſes from weakneſs and laxity of the ſolids.

Its doſe is from four grains to a ſcruple; Dr. Lewis, obſerves, that it may be conveniently exhibited in the form of a bolus, that it is nauſeous in a liquid form, unleſs in ſpirituous tincture; and that it occaſions pills to ſwell and crumble, except ſuch as are made with gums.

Third Claſs.

THIS claſs comprehends thoſe preparations in which iron is diſſolved by acids in a liquid form; to which claſs belongs, 1. The lixivium Martis. 2. The tinctura Martis in ſpiritu ſalis. 3. The tinctura florum martialum. 4. Tinctura ferri vitriolata. 5. The tinctura ferri acetata. 6. The vinum chalybeatum. 7. Briſk chalybeate and vitriolic mineral waters.

Lixivium Martis.

LIXIVIUM Martis, ley of iron, is the matter which remains in the bottom of the ſubliming veſſel, after the flores martiales are ſublimed, expoſed to the air in a moiſt place till it runs per deliquium. Upon examination it proves to be a ſolution of that part of the iron which does not riſe in ſublimation, by the marine acid of part of the ſal ammoniac employed in the proceſs: its taſte is aſtringent and ſomewhat ſweetiſh: it may be given in drops in any convenient vehicle, and uſed as other preparations of iron.

Tinctura Martis in Spiritu Salis.

2. *TINCTURA Martis in ſpiritu ſalis*, —tincture of iron in ſpirit of ſalt. This is a tincture drawn from ſix ounces of filings of iron by means of three pounds of the ſtrong vitriolic acid, and three pints of rectified ſpirit of wine; ſo that it in fact comes to be a tincture prepared with a dulcified, inſtead of a pure muriatic acid; and is nearly of the ſame nature as the *tinctura Martis*

Martis of the Edinburgh diſpenſatory, which is ordered to be made by digeſting three ounces of the filings of iron in two pounds of the dulcified ſpirit of ſea ſalt, for three days. Both theſe tinctures are eſteemed to be good preparations of iron; and when properly diluted, are given in doſes from one to two drams, twice or thrice in the day.

Tinctura Florum Martialum.

3. *TINCTURA florum martialum.* This tincture of the flowers of iron was formerly much uſed, but lies now neglected; it was made by digeſting four ounces of the flores Martis in a pint of proof ſpirit, and ſeemed to contain only ſuch parts of the iron as had been diſſolved by the acid of the ſal ammoniac, combined with the vinous ſpirit.

Tinctura Ferri Vitriolata.

4. *TINCTURA ferri vitriolata.* This vitriolated tincture of iron is prepared by macerating for a week, a dram of the calcined green vitriol in two pints of proof

ſpirit; and contains ſuch parts of the iron as a proof ſpirit is capable of drawing from the calcined vitriol. It makes a pleaſant tincture, and has been uſed as other chalybeates.

Tinctura Ferri Acetata.

5. *TINCTURA ferri acetata,*—acetated tincture of iron. Monſ. Morveau, in the third volume of his Chymiſtry, mentions a tincture of iron prepared by digeſting the crocus or calx of iron, precipitated by an alkali from a ſolution of the green vitriol in water, in the concentrated acetous acid; which, he ſays, is limpid and of a deep red or blood colour, and is infinitely preferable for medical purpoſes to any of the preparations made with cryſtals of tartar. It is ſomewhat ſimilar to the tincture drawn with diſtilled vinegar from the filings of iron, which goes by the name of *Dr. Ratcliff's tincture of iron,* which is ſtrong and of an elegant yellow colour.

Vinum Ferratum.

6. *VINUM chalybeatum,* or *vinum fer-*

ratum, commonly called chalybeate wine. It is commonly prepared by macerating without heat for a month, an ounce of the filings of iron in a pint of wine; in general good old Rheniſh is preferred to other wines, as being more tart and likely to make a ſtronger tincture, though other wines are ſometimes uſed. This is a very elegant preparation of iron, generally ſits eaſy on the ſtomach, and has been much uſed for ſtrengthening weak habits. Dr. Boerhaave eſteems it as one of the nobleſt medicines he was acquainted with for promoting digeſtion, and ſtrengthening the ſtomach, and the whole animal frame. It is given in doſes from a dram to half an ounce.

Briſk Chalybeate and Vitriolic Mineral Waters.

7. THE iron in the briſk chalybeate waters is commonly ſuſpended in them by means of the aerial acid, called fixed air; and in the vitriolic, by the vitriolic acid; and ſome waters have the iron ſuſpended, partly by the one, and partly by the other. As I

ſhall hereafter treat of mineral waters particularly, I ſhall take no further notice of them at preſent.

SECT. VII.

LEAD.

Plumbum, called by the Chymiſts, Saturnus.

LEAD is found in this as well as in many other countries, in large quantity, in mines.

It is the heavieſt of the metals except gold; its ſpecific gravity being to that of water as 11,300 to 1000.

It may be diſſolved in all acids by proper management: none of its ſolutions in mineral acids are at preſent uſed for medical purpoſes. Monſ. Morveau tells us, that if two drams of lead be diſſolved in two ounces of the pure nitrous acid mixed with five ounces of diſtilled water, and the ſolution be evaporated to a certain length, and then ſet in a cool place, that a nitrous ſalt of lead forms itſelf into cryſtals, which has the ſingular property of detonating without flaming; and that it is ſaid to make a ſtronger gunpowder than the common.

It diſſolves in oils, by the aſſiſtance of heat; but it is not ſoluble in pure water.

Lead calcines the eaſieſt of any metal. When it is reduced, by the force of fire, to the ſtate of an aſh-coloured calx, it is called *plumbum uſtum*, or *burnt lead*. If the calcination is continued longer, till it acquires a deep red colour, it is called *minium*, or *red lead*. If continued ſtill longer, it runs into *glaſs*. But if ſuch a ſtrong heat is applied to the burnt lead as to melt it, before it comes to the ſtate of minium, it runs into a fluid, like oil; which, when cold, concretes into a yellowiſh or reddiſh ſubſtance, called litharge.

None of thoſe preparations made by the force of fire, are ever directed to be taken as internal remedies; they are only employed for making ointments, plaſters, &

&c. when diſſolved in oils, or in other unctuous ſubſtances, as may be ſeen in the Pharmacopœia ſubjoined.

It is, as I before obſerved, eaſily acted upon by all acids; and ſpirits, wines, and other liquors, which have an acid in their compoſition, affect and diſſolve, in part, lead put into them; and thereby acquire a noxious quality; and formerly wine-merchants uſed to ſweeten ſour or pricked wines, by mixing preparations of lead with them; but this practice has been forbid, on account of the bad effects which ſuch wines produced. When wines are adulterated with lead, if ſpirit of ſea-ſalt be dropped into them, each drop will occaſion a white cloud, and precipitate the lead, in form of a white powder; and if a ſolution of hepar ſulphuris be dropped, it immediately occaſions a livid or dark-coloured cloud. and precipitate.

Pure water, as I already obſerved, does not diſſolve lead, but hard waters, impregnated with an acid, or with neutral ſalts, do, and often act upon leaden ciſterns; in which they are kept, and acquire a noxious quality thereby; and therefore people ought to be very cautious about what waters they keep in leaden veſſels, or which run through leaden pipes.

There are but two preparations made from lead by means of the acetous acid, which are now retained in the Diſpenſatory; and theſe are the *ceruſſa*, white lead, and the *ſaccharum ſaturni*, ſugar of lead.

Ceruſſa.

THE ceruſs, or white lead, is prepared by expoſing a number of thin plates of lead to the ſteams of vinegar, raiſed by a gentle heat, for three or four weeks, till they are corroded, and appear covered with a white powder. At the end of this time, if the plates are not totally calcined, they ſcrape off the white powder, and expoſe them again to the ſteam of vinegar, till all the lead is thus corroded into a white powder.

Saccharum Saturni.

THE *ſaccharum ſaturni*, or *ſal plumbi acetatus*, the ſugar or ſalt of lead, is the ceruſs diſſolved in diſtilled vinegar, evaporated and cryſtallized; ſo that it is a true ſalt of lead, prepared with the acetous acid; and is the only preparation of lead that is now uſed as an internal remedy. It is aſtringent and ſtyptic; and Dr. Boerhaave ſays, that it coagulates the blood very readily.

Medical Virtues of Saturnine Preparations.

THE preparations of lead have been long employed as external remedies.

Five ounces of *litharge*, diſſolved in a gallon of olive oil, and boiled up to a proper conſiſtence along with water, to prevent its burning, makes a plaſter, which is much uſed; it formerly went by the name of *emplaſtrum commune*, but is now called *emplaſtrum lythargyrites*, and it ſerves for the baſes of many other plaſters in moſt diſpenſatories.—*Minium* uſed likewiſe to be employed in the compoſition of plaſters; but is now laid aſide for that purpoſe, as being entirely of the ſame nature as the litharge.

Acetum lythargyrites, or litharge diſſolved in vinegar, by digeſting about four ounces of it in a pint of vinegar, and afterwards ſeparating the thick part which has ſubſided, has been long employed by ſurgeons as a diſcutient and drying remedy.

A few years ago, a French ſurgeon, of the name of Goulard, in a treatiſe on the Effects of Lead, mentioned a very ſtrong vinegar of this kind, under the name of an *extract*, to ſerve for the making of ſeveral preparations, which he has recommended as preferable to thoſe in common uſe. His *extract* is ordered to be made by boiling four pounds of litharge in an equal weight of wine-vinegar, in a glazed earthen veſſel, for an hour and an half; and then to allow the liquor to cool, and to let drop the thick feculent part, and to pour off the clear liquor, which is a vinegar, fully ſaturated with lead, and to keep it for uſe.

This extract, in the preparation of which there ſeems to be a great deal more litharge uſed than is neceſſary, he principally employed for making waſhes, liniments and ointments; of which his *aqua ſaturni*, or *eau vegetale*, has been in the greateſt repute. It is made by mixing one dram (a coffee-ſpoonful) of the extract, and two drams of brandy, with a quart of pure water. It has been uſed for fomentations; made into poultices with crumbs of bread, and been applied as a diſcutient, to ſwelled and inflamed parts. It has been employed as a collyrium to the eyes, as a waſh for removing pimples from the face, and as an injection to fiſtulous ſores. It differs very little from the ſolutions of the ſaccharum ſaturni, which have been long in uſe in this country; neither do his liniments and ointments differ materially from thoſe made with ceruſs and ſaccharum ſaturni, as directed in the London and Edinburgh Diſpenſatories.

With regard to the external uſe of preparations of lead, particularly of thoſe which are diſſolved in a watery menſtruum, it ought to be obſerved, that if they be applied to a large ſurface for ſome days, or if their uſe be continued long, that ſometimes part of them is abſorbed, and occaſions troubleſome ſymptoms: and Dr. Boerhaave obſerves, that where they have been employed as coſmetics, for a conſiderable length of time, that they have hurt the conſtitution, and even brought on conſumptions.

Formerly, the ſaccharum ſaturni, and other preparations of lead, were employed as internal remedies, and were believed to be powerful aſtringent, and healing medicines; and were given to put a ſtop to the fluor albus, gleets, diarrhœas, dyſenteries, and other immoderate diſcharges, and for removing other complaints; but the violent cholics, ſpaſms, palſies, and other troubleſome complaints, which were obſerved ſometimes to follow the drinking wines or other liquors, impregnated with lead, and the taking of ſaturnine medicines, and the daily inſtances of houſe-painters, plumbers, miners, and of thoſe employed in the manufacture of the ceruſs, and in other manufactures where lead is uſed, has deterred many cautious phyſicians from uſing any of the preparations of lead as internal remedies; however, ſome practitioners have continued to give the ſaccharum ſaturni, and have found it to be a uſeful medicine, for putting a ſtop to uterine and other hæmorrhagies, which had reſiſted the effects of other remedies. I have ſeen ſeveral inſtances where it has produced the beſt effects in ſuch caſes, without occaſioning the leaſt inconvenience; I therefore think, that where other medicines fail, and the patients are in danger of dying from the bleeding, that a phyſician is certainly juſtified in ordering this. I ſhould be very ſorry to recommend it for general uſe, in caſes where danger was not threatened; but certainly, in deſperate ones, every thing ought to be tried, that is likely to give relief. Probably, in moſt caſes of this kind, if the uſe of the ſaccharum ſaturni be laid aſide ſoon after the hæmorrhage is ſtopped, no miſchief will enſue; for, from the accounts of a great many patients whom I have had under my care at St. George's Hoſpital, who laboured under the colica pictonum, it ſhould ſeem, that almoſt all of them had worked in lead for ſome time before they were affected by it; which has made me in ſome meaſure doubt, whether or not the uſe of lead muſt not, in general, be continued for ſome time, before it produces its deleterious effects; though certainly, there are many inſtances of people's being ſoon affected, by even ſmall doſes of its preparations. It is likewiſe probable, that the worſt accident which may happen, after uſing this medicine for a ſhort time, is a ſlight touch of the colica pictonum, which will be removed by a few doſes of cryſtals of tartar, or of purging ſalts mixed with oil, or of ſome other purgative medicine; and by drinking freely of very weak broth, or of oily emulſions, while emollient embrocations and fomentations are applied to the belly, and the patient goes into the warm bath; and by giving opiates after free ſtools have been procured, if any pain remains; but with regard to the uſe of opiates, it ought to be obſerved, that before the patients have had free ſtools, they ought not to be given, unleſs joined to purgatives; for they often aggravate the complaints, by penning up the plumbeous ſuburra within the bowels. The cure of this diſorder, in its firſt ſtage, certainly depends principally on freely emptying the bowels. Bleeding is ſeldom of ſervice, unleſs where there is a ſtrong pulſe, attended with ſymptoms of fever or inflammation.

The doſe of the ſaccharum ſaturni, to an adult, is from five grains to a ſcruple, though ſome practitioners have been bold enough to give it the length of half a dram. It may be given made up into pills, or in almond emulſion, or in gruel, or in any other mild liquor; and ſome have added to it a dram, or two drams, of cryſtals of tartar, with good effect.

SECT. VIII.

TIN.

Stannum, called by the Chymiſts, Jupiter.

TIN is the lighteſt and moſt eaſily fuſed of any of the metals; and, when pure, reſembles ſilver. It is found in many countries; but the county of Cornwall ſupplies the greater part of this iſland with it.

Aqua regia has been reckoned its proper menſtruum; though it is affected, more or leſs, by all the acids. Monſieur Morveau makes the following remarks on the effects of the mineral acids on this metal:

1. That the vitriolic, even a little diluted, diſſolves it: and that the vitriol formed by their union, ſhoots into cryſtals, reſembling needles interwoven with each other; and is deliqueſcent, and extremely cauſtic, in a ſtate of ſaturation.

2. That the nitrous acid rather calcines than diſſolves tin; and that he had not been able to procure a cryſtallized ſalt from their union.

3. That the marine acid diſſolves about half its weight of tin, and the ſolution remains limpid; and that, by evaporation, Monſ. Monet obtained ſolid, long and ſmall cryſtals from it; and that cryſtals formed in the time of cold weather, in ſome of the ſolution which he kept through the winter, but liquefied again in ſummer.

4. That aqua regia diſſolves about half its weight of tin, raiſes a great heat in the time of the ſolution; and that, by evaporating this ſolution with a gentle heat, till a pellicle begins to appear on its ſurface, and then ſetting it in a cool place for three or

four days, ſmall long cryſtals form, which formerly went by the name of *ſal Jovis*.

Dr. Lewis, in his new Diſpenſatory, ſays, that diſtilled vinegar diſſolves the calx of tin precipitated from aqua regia by the ſpirit of ſal ammoniac, and that by evaporating the ſolution to the conſiſtence of a ſyrup, and then adding about one twentieth part of ſpirit of wine, and letting it ſtand in a cool place, ſolid, hard, tranſparent cryſtals will form, which are void of acrimony ; and have been recommended in uterine caſes, in the doſe of a few grains ; but experience has not warranted the virtues attributed to them.

Formerly, the preparations of tin were eſteemed to be powerful remedies for curing many diſorders, particularly of the lungs, the liver and uterus ; but at preſent none of them are in uſe, and all of them have been thrown out of moſt late diſpenſatories ; the tin itſelf, in powder, being the only one retained and uſed in practice.

The tin, as it is commonly ſold, has been alledged by Dr. Lewis to contain a pittance of arſenic ; for he ſays, if its filings be held in the flame of a candle, they emit a thick fume, ſmelling of garlick, which is univerſally held in mineral ſubſtances to be a criterion of arſenic; but the late Dr. Alſton has, in his Materia Medica, denied this fact; and told us, that he again and again made the experiment, and could not diſcover any thing like the ſmell of garlick; and that the freeing the tin of arſenic was abſolutely neceſſary for its reduction; and Macquer, in his Chymiſtry, ſays, that the marks by which tin is known to be ſufficiently roaſted are, its having loſt the ſmell of garlick, and its having no effect in whitening a clean plate of iron, held over it in fuſion. If there is a pittance of arſenic in block tin, it is certainly ſo locked up or fixed by it, as to diſcover no virulence, or produce any bad effects; and Dr. Alſton obſerves, that he himſelf, and many other phyſicians, have given the powder in large quantities, without occaſioning any uneaſineſs or bad ſymptom whatever; and I have often ordered this medicine, and ſeen others give it, but never ſaw any bad effects follow from its uſe.

Pulvis

Pulvis Stanni.

THE tin itſelf, reduced to a powder, either with a file, or by rubbing it, when melted, in a mortar, or ſhaking it in a box with chalk, are the only two forms in which this metal is at preſent uſed as a medicine in this country.

It may be reduced to powder, by pouring it, when melted, into a wooden box, chalked within, ſhaking the box briſkly, till it grows cold; by which means, part of it will be reduced to powder; and by treating the remains in the ſame manner, it will be reduced to powder likewiſe.

Or it may be reduced to powder in the following manner, recommended by Dr. Alſton: Pour melted block-tin into a pretty large iron pot, conſiderably heated, and with a large iron peſtle, alſo heated, rub it ſtrongly and conſtantly in the pot, till it is almoſt all reduced to a powder; and what is not, may be again melted and rubbed, as before.

Many prefer the filings of tin, to its powder prepared in any other way.

The tin had been long uſed as a medicine for worms, by ſome particular people; but it was not brought into repute among phyſicians till the year 1730, that the late Dr. Alſton, of Edinburgh, publiſhed an account of its uſe in worm caſes, in the 5th volume of the Edinburgh Medical Eſſays; in which he ſays, "this is ſo ſucceſsful a medicine for worms in the inteſtines, that it deſerves as well to be called a ſpecific as any drug I know."

The general doſe has been from a ſcruple to a dram; but Dr. Alſton aſſures us, that its ſucceſs depends chiefly on its being given in much larger quantity. To a full-grown perſon, after having cleared the bowels with an infuſion of ſenna and manna, he directed an ounce of the tin powder, mixed with four ounces of the common treacle or molaſſes, to be taken early in the morning, faſting; and the ſame doſe to be repeated next morning; and the morning following a doſe of only half the quantity;

ty; and on the fourth morning, he ordered the purging infuſion to be repeated. The worms, he ſays, do not commonly come away while the patient is taking the tin powder, but during the operation of the laſt purge; and that the pains of the ſtomach, occaſioned by the worms, are commonly removed, upon taking the firſt doſe of the tin. If any ſymptoms of worms appear after this, he directs the ſame courſe to be repeated at the end of a month. The Doctor ſeems to think that the efficacy of this medicine chiefly depends on its irritating the worms, and getting between them and the inner coat of the ſtomach and inteſtines, and making them quit their hold; ſo that they are eaſily brought away, by the operation of the purgative medicines. That the medicine acts in this way, he ſays, ſeems probable, by the worms coming away, generally, alive.

I have often given the tin powder in the manner recommended by Dr. Alſton, and at other times have directed a dram of it to be taken four or ſix times in the day for a number of ſucceſſive days (for a fortnight or more), while the patient took a purgative medicine every fourth day; and I have cured many by theſe means, though it did not anſwer equally well in every caſe in which it was adminiſtered; and I never ſaw any troubleſome ſymptom occaſioned by the free uſe of this drug.

Tin powder has likewiſe been recommended as an antiſpaſmodic, and is ſaid to have cured the epilepſy: I have often given it with that intention. It ſucceeded in four or five caſes, in which it was adminiſtered freely; but theſe evidently depended on worms, for the patients voided ſome on taking purgative medicines, after the uſe of the tin; and it produced no good effects with a great number of other epileptic patients, to whom I preſcribed it, who were not troubled with worms.

The aurum muſivum was the laſt of the preparations of tin that was retained in the London Diſpenſatory. It was formerly eſteemed to be a uſeful medicine in hyſterical and hypochondriacal diſorders;

orders; but from obſervation and experiment it has been diſcovered to be an inert calx of tin, which owes its colour to a minute portion of ſulphur which adheres to it.

CHAP. VIII.

SECT. I.

Of Metallic Subſtances called Semimetals or Demimetals.

HAVING conſidered the true metals, I come next to take a view of thoſe ſubſtances called *ſemimetals*, which have been uſed in medicine, which are *quickſilver*, *antimony*, *zinc*, *biſmuth*, and *arſenic*; to which I ſhall add a few ſubſtances that contain metallic particles, viz. *lapis calaminaris*, *tutia*, and *lapis hæmatitis*, though perhaps, properly ſpeaking, they ought not to be brought under this head.

SECT. II.

Quickſilver, or Mercury.

ARGENTUM Vivum, called by the Greeks *hydrargyros*, and by the chymiſts *mercury*, is a fluid metallic body, heavier than any other known ſubſtance, except gold and platina; its ſpecific gravity or weight being to that of water as 1,419 to 1000.

There are conſiderable mines of it in Hungary and in Spain; and it is brought in great quantity from the Eaſt-Indies: it is commonly got from an ore compoſed moſtly of ſulphur and quickſilver, which is greatly richer of the quickſilver in ſome mines than in others; ſome ores yielding a ſmall quantity, others a half, and ſometimes two-thirds. The ore generally goes by the name of native cinnabar, and is ſometimes of a dark brown colour mixed with red; at other times, of a dark red, which improves in its colour by being ground in a mortar; ſometimes it is of the conſiſtence of bole, at other times it is as hard as ſtone: ſometimes, though more rarely, the quickſilver is found in a fluid ſtate, collected in pools in the mine, or running in a ſmall ſtream through the chinks of the earth, in which ſtate it is called virgin quickſilver.

It is ſeparated from its ore principally by the force of fire; and as it would be foreign to my preſent plan to treat of the different methods practiſed for that purpoſe, I ſhall refer thoſe who wiſh for further information on this head, to Cramer's Ars Docimaſtica, Savary's Dictionary, and other books which treat on this ſubject.

The quickſilver that is ſold for pure, is often adulterated with lead, biſmuth, and other metallic ſubſtances; but this may be eaſily diſcovered by putting it into vinegar, when if it be pure, it will give no taſte to the vinegar; but if it is not, it will give it a ſweetiſh one.

When it is not pure it has commonly been ordered to be preſſed through leather, to ſeparate it from the lead, or other heterogeneous matter it may happen to be mixed with; but this is not ſufficient, for it will carry thoſe ſubſtances along with it. The beſt method of obtaining it quite pure, is to mix it with filings of iron, or with quicklime, or with potaſhes, and to diſtil it; for theſe ſubſtances will join with the extraneous matter with which it was adulterated, and will remain behind with them in the retort, while the quickſilver will riſe and come over into the receiver.

It riſes in form of vapour on the application of a ſmall degree of heat; and however much it be changed, or in whatever form it may appear, it can always be reduced to its original fluid form, by the means of heat and proper management.

It was looked upon by the ancients as a poiſon; owing probably to the miſchiefs they obſerved to happen to thoſe who worked in its mines, who ſeldom live above three or four years.

It was firſt introduced into practice by the Arabians, ſome time about the eleventh or twelfth century.

When pure, it is a fine fluid metallic ſubſtance, of the colour of ſilver, that has neither taſte nor ſmell; and when taken down into the ſtomach without any preparation, it commonly paſſes by ſtool, nearly in the ſame form it was ſwallowed; without any of it, or but a ſmall pittance being taken up by the lacteals into the blood, as repeated experience has ſhewn; for about the beginning of the preſent century, during Queen Anne's reign, it was the faſhion to take crude mercury for almoſt every complaint, and even as a preſervative of health. The obſervations which the phyſicians made at that time were, that in general it produced no ſenſible effects, but paſſed unchanged in a very ſhort time through the body; that a few aſthmatic people, and others who laboured under a difficulty of breathing, were believed to have received benefit from its uſe; which has ſtill kept up a notion with ſome practitioners, that it is a good medicine in ſuch complaints: that a few people were ſalivated by it, owing to the mercury having been ſome how or other ſo united with the mucus of the alimentary canal, as to be fit to enter the lacteals and act upon the animal ſyſtem; and that a few ſuch accidents happening, had put an end to the faſhion of ſwallowing quickſilver. Now it is almoſt only uſed in its crude ſtate as a medicine, in order to relieve the breathing, or to force a paſſage through the bowels in caſes of obſtinate coſtiveneſs.

But though it is ſo inactive in its crude fluid ſtate, yet when its particles are ſubtilely divided by being well rubbed with viſcid, tenacious, or other ſubſtances, or when it is calcined by heat, or corroded with acids, but made ſufficiently mild to be taken by way of medicine, it enters the blood and produces very ſenſible effects; for it then promotes all the different ſecretions by ſweat, by urine, and by ſtool; and it affects the ſalivar glands in a particular manner; for it cauſes a ſoreneſs and itching of the gums, and a coppery taſte in the mouth, attended with a fetid ſmell of the breath, which is very ſoon followed with a conſiderable flow of humours from the ſalivary glands, if its uſe be continued; and the pulſe becomes quick.

Its effects on the blood ſeem to be, to render it more of a putreſcent nature; for the breath and all the ſecreted liquors of people under a courſe of mercury ſmell ſtrong, and the craſis of the blood is much broke down; though ſome practitioners ſeem to be of a contrary opinion, and think that the blood is not in any way changed by the uſe of mercury, though they allow that the ſaliva is of a more putreſcent nature, than at other times; but think that it ſuffers that change in the excretories of the ſalivar glands.

It produces the ſame effects, whether it be taken up into the blood by the abſorbent veſſels of the alimentary canal, or by thoſe of the ſkin, when mercurial ointments are rubbed on it.

It has been much diſputed among practitioners how mercury acts, whether by its ſpecific gravity, or whether as a ſtimulus affecting certain organs. Dr. Aſtruc ſeems to imagine that it acts moſtly by its ſpecific gravity, but to me it appears that although its weight may have ſome effect, yet that it ſeems evidently to act by its ſtimulus, and to be of ſuch a nature as to affect ſome organs more particularly than others, and to produce a conſiderable change in the nature of the humours of the whole body.

Mercury is moſt commonly uſed for the cure of the lues venerea, which it effectuates either by ſo changing the morbid venereal particles, as to alter their nature, and to render them mild like the other juices; or by evacuating them out of the body by the different outlets; or in both theſe ways; but it ought to be obſerved, that it never carries off the venereal taint, unleſs ſome one or other of the ſecretions be increaſed, and this diſcharge be kept up for ſome time.

In ſlight venereal caſes it is often ſufficient to give mercury, only in ſmall repeated doſes, ſo as to gently promote the ſecretions by the ſkin, the kidneys, or the bowels, and to continue its uſe for ſome time; but where the diſeaſe has taken deep root, it is neceſſary to give ſuch a quantity of it, as to enter the blood, and to promote a gentle ptyaliſm; or to throw in ſuch a quantity of it, by rubbing mercurial ointment on the ſkin, as will produce the ſame effect. Having, in the chapter on the venereal diſorder, in the *ſecond volume of the ſecond edition of my Obſervations on the Diſeaſes of the Army*, mentioned the particular preparations of mercury proper to be uſed in the different ſtages of the venereal diſorder, and the methods it was neceſſary for the patients to purſue, I ſhall ſay nothing farther on this ſubject at preſent, but refer thoſe who wiſh to be further informed of my ſentiments on that head, to theſe Obſervations.

Mercury is not only of uſe in the cure of the venereal diſorder, but in that of many others.

It ſometimes proves a ſtrong antiſpaſmodic, and gives relief in caſes where no other medicine has had any effect. Dr. *Home*, in his Clinical Experiments, tells us, that ſeven grains of mercurius dulcis, given every night till it raiſed a ſalivation, removed a dangerous difficulty of ſwallowing, which proceeded from ſpaſm.

A ſalivation raiſed by mercury, aſſiſted by the uſe of opium, has cured a number of people labouring under the tetanus, or locked jaw; and though it has not ſucceeded in every caſe, yet it ſeems to have been amongſt the moſt ſucceſsful remedies hitherto tried; and it, or the uſe of the cold bath, are the two means at preſent held in moſt repute by practitioners in the Weſt Indies. In the year 1766, I ſent to the ſociety at Edinburgh, an account of obſervations on this ſubject which had been communicated to me by a gentleman who had formerly practiſed phyſic in the iſland of Jamaica, which was inſerted in their third volume of Phyſical and Medical Obſervations, along with the hiſtory of a caſe of the ſame kind which had been ſucceſsfully treated by my brother, the profeſſor of anatomy; and ſince that time I publiſhed in the year 1776, in the Prælectiones Medicæ which I had read before the college of phyſicians, the account of ſeveral other caſes of the ſame kind, which had been treated by mercury.

In the ſixth volume of the London Medical Obſervations and Inquiries, and in the late volumes of the Edinburgh Medical Commentaries, there are caſes related of internal hydrocephali which are ſaid to have been cured by ſalivation raiſed by mercury. And in the firſt volume of the London Medical Tranſactions, the late Dr. N. Munkley gives an account of conſtrictions and thickening of the œſophagus having been cured by the ſame means. And in the third volume of the ſame work, Mr. Knight mentions two caſes of obſtructed liver, which were ſucceſsfully treated by mercurial frictions. And we have many ſimilar caſes related by many late authors.

It is a long time ſince mercury has been employed in the Eaſt Indies for the cure of the hepatitis, or inflammation of the liver; and it has ſince been given in the Weſt Indies with equal ſucceſs. After bleeding the patient according to the exigency of the caſe, and giving ſome mild purging medicine, practitioners in that country order a ſtrong mercurial ointment to be rubbed on the region of the liver, and at the ſame time direct doſes of ſome mild mercurial preparation, ſuch as of mercurius dulcis, or of a quickſilver pill to be taken at proper intervals, till a gentle ſpitting is raiſed, or the inflammation is removed; and they have found that the ſooner the ſpitting is raiſed, the ſooner the patient gets well; and that if the mercurial courſe is omitted, that often the liver ſuppurates ſoon.

In the year 1764, a gentleman who had practiſed phyſic in the Eaſt Indies having communicated this method of treating the hepatitis to Dr. Hamilton of Lynn Regis, he, concluding that the general cauſe, be what it may, of an inflammatory diatheſis muſt be the ſame in what part ſoever the inflammation is ſeated, reſolved to try the effects of mercury in the cure of inflammations in this country; and after trial found that it produced equal good effects in removing pleuriſies, peripneumonies, ophthalmias, and other local inflammatory complaints, as it had done in curing the hepatitis in India; that it removed the acute inflammatory rheumatiſm, and gave moſt happy relief from excruciating pain in a highly inflammatory gout; and that it proved of equal benefit in inflammations ariſing from external injuries, as thoſe which proceeded from an internal cauſe. After having uſed mercury for eighteen years in the caſes mentioned, Dr. Hamilton in the year 1785, publiſhed a ſummary account of his practice in the ninth volume of the Edinburgh Medical Commentaries, where he obſerves, that the efficacy of the calomel is greatly improved by the addition of one-fourth or one-fifth part of opium; and that the moſt extraordinary and early relief he ever ſaw calomel give was in the phrenitis and paraphrenitis, as he had experienced in a great number of caſes.

The ſame Dr. Hamilton, in the ſixty-ſixth volume of the Philoſophical Tranſactions, after giving the hiſtory of a caſe of a ſuppreſſion of urine, which was relieved by making a puncture in the bladder; obſerves, that a compoſition of calomel and of opium in large doſes, was amongſt the beſt remedies in a ſuppreſſion of urine.

Mercury often ſo changes the habit of body as to make thoſe ſores heal in a ſhort time which have long reſiſted the effects of other medicines; and it likewiſe often produces the ſame effects on ſwellings and ulcers of the legs, which remain after the ſea ſcurvy, when the ſcorbutic taint is gone, and the gums have become ſufficiently firm.

It removes many cutaneous complaints, and has been recommended as a cure for the leproſy; but I have ſeen a number of people ſalivated for this diſorder, and it generally removed the cutaneous eruption for a few weeks, but in leſs than two months it for the moſt part began to appear again, and in a ſhort time became as bad as ever. I never ſaw one complete cure made in this way.

It frequently aſſiſts in reſolving glandular obſtructions, both when rubbed in form of an ointment and when taken internally.

It is given in ſmall repeated doſes either by itſelf, or joined with ſquills, or with camphor, or with opium, for promoting the different watery ſecretions; I have often ſeen it carry off the water in anaſarcous caſes, and although I have ordered it to great numbers of poor people labouring under the true aſcites in the ſpace of thirty years, I never but thrice ſucceeded in carrying off the water by its means.

It aſſiſts greatly in deſtroying and evacuating worms, and therefore is often given in ſuch caſes, either by itſelf, or joined to purgative medicines.

In ſhort, mercury is given at one time to change the ſtate of the blood; at another as a diſcutient; at a third with an intent of promoting the different ſecretions, and to remove obſtructions, &c. and it has been found to anſwer all thoſe ends when properly adminiſtered.

If mercury, when its particles have been divided by being triturated with oily ſubſtances, be rubbed on the ſkin, it enters the blood and produces the ſame effect as when taken by the mouth: and when it is rubbed in this form on ſwelled or tumified parts, it often proves a powerful diſcutient, eſpecially if it be joined with camphor or other things which give a briſk ſtimulus.

Pure mercury or quickſilver is of itſelf inſipid, and inactive, when taken down into the ſtomach; and it has been alleged by many chymiſts, that it muſt be ſo changed, either by its particles being ſo divided by being triturated with other bodies, or by its being ſo acted upon by ſalts, as to become a little acrid, and acquire more or leſs of a copperiſh taſte, before it is capable of acting on the human body, and of producing the effects commonly attributed to mercury: and they have aſſerted, that this ſlight degree of acrid copperiſh taſte is the criterion by which active preparations of mercury may be diſtinguiſhed, *a priori*, from thoſe which are not ſo. But how far this may be true I cannot ſay, having never made a ſufficient number of obſervations or experiments to determine this queſtion.

Mercury and its mild preparations, when they once enter the blood, ſeem to act in the ſame manner, however they may have been prepared; or in whatever form they may have been adminiſtered; at leaſt ſo far as we can diſtinguiſh by our ſenſes; though it may require different quantities of the different preparations to produce the ſame effects; but ſome of the preparations made by corroding it with the mineral acids, particularly the nitrous, ſeem to acquire a degree of acrimony which is hurtful to the conſtitution; if great care and caution is not uſed in adminiſtering them.

The preparations of mercury are many, but they may be divided into the following ſix claſſes:

1. Thoſe in which the particles of mercury are divided by means of mild dry powders.

2. Thoſe where its particles are divided by means of mucilages, inſpiſſated juices, ſaccharine ſubſtances, and balſams.

3. Thoſe where they are divided by means of oils, or unctuous matters.

4. Thoſe where mercury is united with ſulphur.

5. Thoſe where it is reduced to the ſtate of a calx, by the mere force of fire.

6. Thoſe where it is reduced to the ſtate

of a mercurial ſalt, by means of acids; or where it is reduced to the ſtate of a calx, by being precipitated, by alkaline ſalts, when diſſolved in an acid.

Firſt Claſs.

THE preparations in which the particles of mercury are divided, by means of mild dry powders, have not been much uſed; both on account of the trouble in preparing them, and becauſe, as they have no metallic taſte, it has been doubted whether they are ſo efficacious as many other mild preparations in common are.

There are no preparations of this kind ordered in the late editions of the London or Edinburgh Diſpenſatories; but the two which have been moſt in vogue are; 1. The *mercurius alkaliſatus*; And 2. The *mercurius gummoſus.*

Mercurius Alkaliſatus.

THE *mercurius alkaliſatus* was prepared by rubbing three parts of quickſilver with five of prepared crabs eyes, in a glaſs or marble mortar, till the globules of the mercury diſappeared. It was recommended as a mild alterative in cutaneous and venereal caſes, and has been preſcribed in worm caſes of children.

Mercurius Gummoſus.

Mercurius gummoſus, is quickſilver rubbed in a mortar with powdered gum arabic till the globules diſappear. It forms a black powder, which has been recommended by Dr. Plenk, as a mild mercurial medicine, and uſeful for curing venereal complaints.

Second Claſs.

COMPREHENDS thoſe preparations where the particles of quickſilver are divided, by being rubbed in a mortar with honey; or with ſoftened vegetable extracts; or with manna, or with ſugar and a few drops of ſome eſſential oil; or with conſerve of roſes; or with balſam copaivi, or balſamum canadenſe; or with ſuch other viſcid tenacious ſubſtances, till the globules of the quickſilver entirely diſappear, and they form with them a black maſs; which, with the addition of the powder of liquorice-root, or of ſtarch, or of ſome ſuch other mild ſubſtance, form the mercurial *pills* or *boluſſes* of moſt diſpenſatories. The quickſilver, by being rubbed down with theſe tenacious ſubſtances, acquires a metallic taſte, and becomes an active mercurial preparation; the doſe of which is ſuch a quantity as contains from three grains to ten or more of the quickſilver.

Squills, gums, purging powders and extracts, and other medicines, are frequently joined to mercury thus divided, in place of powder of liquorice-root or of ſtarch, in order to render them more active, diuretic, purging, or pectoral remedies.

Third Claſs.

CLASS third comprehends thoſe preparations where the quickſilver is divided by means of oil or unctuous matter, which are moſtly employed for forming *mercurial ointments* and *liniments.*

Mercurial Ointment.

QUICKSILVER rubbed with hogs-lard, with the addition of a ſmall portion (from a 12th to a 24th part) of ſuet, forms the *mercurial* ointments of the New London and New Edinburgh Diſpenſatories. Two ſorts of theſe ointments are in common uſe; a *ſtronger*, and a *weaker.* When equal parts of quickſilver and of unctuous matter is employed, it is called the *ſtrong mercurial ointment*; when there is only one part of quickſilver to three or four of the unctuous matter uſed, it is called the *weak mercurial ointment.*

Formerly, in order to facilitate the union of quickſilver with the hogs-lard, practitioners uſed to add a little turpentine, or balſam, in the preparation of all theſe ointments; but it has been found that ointments, thus prepared, fret and inflame the ſkin, when rubbed upon it, and anſwer no good purpoſe; and therefore, they are now generally omitted in ointments prepared for rubbing on the ſkin, and only a ſmall portion of ſuet is added to the lard, to give it a proper degree of firmneſs; though theſe balſams are ſometimes added to ointments prepared for dreſſing ſores and ulcers.

Mercurial ointments, made with hogs-lard alone, for rubbing on the ſkin, anſwer extremely well in winter, if they be kept in a cool place, and be immediately uſed; but in ſummer, or if they be kept in a warm place, the lard is apt to become too thin, and to let drop a conſiderable part of the quickſilver.

The French think, that the more intimately the quickſilver is united with the lard, the more efficacious the mercurial ointments are; and therefore, they often order ſuch ointments to be rubbed conſtantly in a mortar for 24 hours, even after the globules of the mercury have diſappeared; but whether any advantage is gained by this long trituration, I cannot ſay.

When ſuch ointments are rubbed on the ſkin, the divided quickſilver is taken up by the cutaneous abſorbent veſſels, conveyed by them into the general maſs of blood, and produces the ſame effects as other mercurial preparations taken by the mouth.

Such a quantity of the ointment as contains from half a dram to a dram of quickſilver, rubbed well on the ſkin every day, till the ſkin appear almoſt dry, generally begins to affect the mouth, on the third, fourth, or fifth day. When we wiſh that the mercury thus thrown into the blood ſhould act as an alterative, the ointment is to be rubbed in only once in two or three days. If we wiſh to raiſe a ſalivation, where no particular ſymptom requires the mercury to be thrown in very quickly, it may be rubbed in once a day; but in the locked jaw, and in other urgent caſes, where we wiſh the mercury to take effect very ſpeedily, it may be rubbed in twice a day; viz. morning and evening.

After mercurial ointment has been rubbed in two or three times, particular attention ought to be paid to the effects it produces; for by theſe, often, both the quantity of ointment to be afterwards uſed, and the frequency of the frictions, muſt be determined.

Fourth Claſs.

THIS claſs contains thoſe preparations where quickſilver is combined with ſulphur; of which there are commonly two in moſt diſpenſatories, the *æthiops mineral* and *cinnabar.*

Æthiops Mineral and Cinnabar.

QUICKSILVER, rubbed with an equal part of flowers of ſulphur in a mortar till all its particles diſappear, or mixed with melted ſulphur, and kept conſtantly ſtirring, till their union is completed, and then reduced to a fine black powder, is called *æthiops mineral*; and if the powder, prepared in either of theſe ways, be put into a ſubliming glaſs, and a proper heat be applied, it riſes into a dark reddiſh coloured cake, called *factitious cinnabar*; which, when reduced to a fine powder, is of a beautiful red colour.

Both theſe preparations of mercury are mild, and have no acrid coppery taſte, as the active ones generally have; and when taken by way of medicine are often inactive, and produce no ſenſible effects; which ſeems to be entirely owing to the ſulphur involving this active mineral, and preventing its producing its uſual effects.

The *æthiops mineral* is frequently preſcribed for removing cutaneous eruptions, and in worm caſes and other diſeaſes of children. If it is well prepared, it in common produces no viſible effects; though it has ſometimes raiſed a ſalivation; owing, probably, to ſome of the quickſilver not having been intimately combined with the ſulphur.

The æthiops is given in doſes from five grains to forty or more.

Factitious cinnabar was formerly looked upon as a very efficacious medicine, and was often ordered with an intention of removing cutaneous foulneſs, and in gouty, rheumatic and epileptic caſes; but has now loſt moſt of its reputation, and in its ſtate of cinnabar, is looked upon as a very inactive medicine.

The fumes, or ſmoke, ariſing from cinnabar, thrown upon live coals, received upon venereal ſores and ulcers; particularly thoſe of the noſe, mouth and throat, have been recommended by Dr. Turner as a uſeful remedy for drying and healing them; and, in the fourth volume of the Edinburgh Medical Eſſays, Mr. Hill mentions a caſe, where the ſmoke ariſing from only half a dram of cinnabar, drawn up into the mouth and noſe, raiſed a ſalivation in the ſpace of three hours. I have often ſeen theſe fumigations uſed, and frequently to advantage; but I never ſaw them act ſo quickly as mentioned by Mr. Hill. They are certainly active remedies, and may be uſefully applied in particular caſes, where ulcers are ſo ſituated as to be out of the reach of other applications. However, it ought to be obſerved, that the fumes are very different from the cinnabar itſelf; for in the form of cinnabar, the mercury is ſo enveloped with ſulphur, as to be rendered in a manner inactive; but when the fire acts upon it, and raiſes it into ſmoke, it decompoſes it, and diſſipates a great part of the phlogiſton of the ſulphur; ſo that the volatile vitriolic acid, acting upon the fumes of the quickſilver, renders them extremely active.

Fifth Claſs.

THOSE, where the quickſilver is reduced to the ſtate of a calx by the mere force of fire. We have but one preparation of this kind in moſt diſpenſatories, which goes by the name of *mercurius calcinatus.*

Mercurius Calcinatus.

PURIFIED quickſilver, kept for three or four months expoſed to a degree of heat that raiſes the quickſilver in Fahrenheit's thermometer to between four and five hundred degrees, calcines into a red ſubſtance, called *mercurius calcinatus* in our diſpenſatory; which uſed formerly to go by the name of *mercurius præcipitatus per ſe.*

Hitherto it has not been aſcertained with certainty, what quickſilver gains or loſes, to effectuate the change it undergoes by calcination; but however that be, it certainly acquires an acrid metallic taſte, and operates in the ſame manner as the other active preparations of mercury.

This *mercurius calcinatus* has been held in high eſteem by many practitioners, and formerly been looked upon as one of the moſt efficacious remedies for the cure of the venereal diſorder.

I have given a great deal of this preparation of mercury to people labouring under venereal and other complaints, at St. George's Hoſpital; and think, that as an alterative, it is as good and as ſafe a one as we have; given from one to two grains, once or twice in the day, when made up into pills with conſerva fructus cynoſbeti, or other mild conſerves, with the addition of a quarter of a grain of opium to each grain of the mercury. It generally operates as an alterative; though ſometimes it affects the gums, and brings on a ptyaliſm. It is by no means a remedy that I would truſt to for the cure of a confirmed lues venerea; for, like ſome other of the active preparations of mercury, it is apt to bring on a ſpitting before a ſufficient quantity of mercury has entered the blood; and, like them, it ſometimes carries off the ſymptoms, without eradicating the diſeaſe. If given above the quantity of a grain or two for a doſe, it is apt to occaſion griping and uneaſineſs in the bowels, and to bring on a purging.

Sixth Claſs.

THIS claſs takes in all thoſe preparations where quickſilver is reduced to the ſtate of a mercurial ſalt by means of acids; or where it is reduced to the ſtate of a calx, by being precipitated, by means of alkaline ſalts, from its ſolution in acids.

Quickſilver is ſoluble in all the three mineral acids; but not in the acetous, till it has been reduced to the ſtate of a calx, either by being expoſed to heat, or by being precipitated, by an alkali, from its ſolution in ſome of the mineral acids.

SECT. III.

PREPARATIONS with VITRIOLIC ACID.

Mercurius emeticus flavus.

1. THERE is but one preparation made with the vitriolic acid; which is commonly uſed as a medicine, and has a place in moſt diſpenſatories. It was formerly called *turpethum minerale*, or *mercurius emeticus flavus*; but, by late chymiſts, *argentum vivum vitriolatum*, or *hydrargyrus vitriolatus*. It is made thus: Mix quickſilver with double its own weight of the vitriolic acid, in a proper glaſs veſſel, ſet in a ſand heat; then increaſe the heat gradually, till the liquor comes to boil, and keep up the heat till nothing remains in the glaſs, but a white maſs perfectly dried. When the glaſs is ſufficiently cool, pour hot water into it, and the maſs will immediately turn of a yellow colour, and fall into a powder; which is to be repeat-

edly waſhed with freſh water, till it becomes perfectly free of all acrimony.

Dr. Lewis, in his new diſpenſatory, has alleged, that the beſt method of edulcorating this powder is, by impregnating the water intended to be uſed in its ablution, with a determined proportion of fixt alkaline ſalt; for in this way, the waſhed turpeth will not only turn out greater in quantity, but what is of more conſequence, will always have an equal degree of ſtrength; a circumſtance which deſerves to be particularly conſidered in making ſuch preparations, as from an error in the proceſs, it may prove too violently corroſive to be uſed with ſafety.

This preparation acts like other mercurials; but it is of an acrid nature, and muſt be given in ſmall doſes, of one, two, or at moſt three grains, when it is intended that it ſhould act as an alterative; for if a larger quantity is given, it generally proves emetic. Formerly it was much uſed, by way of an alterative, in gonorrhœas and other venereal complaints, after it had been rubbed down with balſamum copaivi; which

was

was believed to render it milder, and a ſmall quantity of opium, to prevent its running off by the bowels.

Dr. Barry, in the third volume of the Edinburgh Medical Eſſays, tells us, that two grains of turpeth, joined to a few grains of calomel, taken while the patient drank freely of a decoction of guaiac wood, always determined the operation of the mercury to the ſkin. Another method of uſing this preparation uſed to be, to rub it down with camphire, and to join it with pilulæ cochæ, for purging patients labouring under the gonorrhœa; but in general it operates too roughly, and does not anſwer the end propoſed, and therefore is now ſeldom given in this form.

It is a ſtrong emetic, when taken from five to ſix or ſeven grains, and operates more powerfully in this way than any other mercurial preparation, that can be given with ſafety; and it has been much uſed in this manner, in ſwellings of the teſticles, proceeding from a venereal cauſe; and has been employed for the cure of leprous complaints, and obſtinate glandular obſtructions.

When given as an emetic, its operation does not ſeem to be confined to the ſtomach and bowels; for ſometimes a ſalivation follows the repeated uſe of ſuch emetics, which ſhews, that the whole is not thrown up by vomiting, but that part of it is abſorbed into the blood.

SECT. IV.

PREPARATIONS with the NITROUS ACID.

Mercurius corroſivus ruber.

QUICKSILVER is eaſily diſſolved in the nitrous acid; and this ſolution was formerly the baſis of many preparations, which are not now in uſe: The only one remaining in the London and Edinburgh Diſpenſatories is, the *mercurius corroſivus ruber*, commonly called red precipitate,

cipitate; which by late chymiſts has been called *argentum vivum nitratum rubrum*, and *hydrargyrus nitratus ruber*. It is made by diſſolving quickſilver in an equal weight of diluted nitrous acid; or nitrous acid mixed with an equal quantity of diſtilled water, and evaporating to dryneſs; and then either keeping up the heat till the dry maſs has acquired a red colour; or, when it is dry, letting it cool, and then, after reducing it to a fine powder, putting it into a glaſs veſſel, or into a crucible, and expoſing it to a great degree of heat, till it becomes red.

This preparation of mercury is too acrid and corroſive to be employed as an internal remedy; and therefore, it is only made uſe of, as a mild eſcharotic, for external application.

Mercurius corallinus.

MERCURIUS Corallinus. In the late edition of the London Pharmacopœia there was a medicine ordered to be kept, under the name of coralline mercury; which was the mercurius corroſivus ruber, after it had been digeſted in three times its own weight of rectified ſpirit of wine, for three days, and the ſpirit had been burnt upon it, while it was kept perpetually ſtirring. Theſe operations were believed to render the red corroſive mild, and fit for uſing as an internal remedy; but experience has ſhewn, that it is ſtill too violent a medicine to be given with ſafety; a few grains of it proving violently emetic and purgative, and it has ſometimes produced troubleſome ſymptoms.

Ward's white Drop.

WARD's white drop. A ſalt of quickſilver prepared with the nitrous acid, which paſſes under the name of Dr. Ward's white drop, is ſtill in uſe. It is made thus:

Take four ounces of a ſaline liquor, formed of pure aqua fortis, and four ounces, ſeven drams and a ſcruple, of pure volatile ſal ammoniac; add to it, by little and little, four ounces of quickſilver, and digeſt them in a ſand heat till the quickſilver is diſſolved; and then add a ſmall quantity more of it, or as much as the liquor will take up, and evaporate till a pellicle appear on the ſurface; then remove it from the fire, and ſet it in a cool place, to allow the metallic ſalt to ſhoot into cryſtals; ſeparate carefully the ſurrounding liquor, and diſſolve the pure ſalt in three times its own weight of roſe-water, by digeſting it in a gentle heat, and keep it for uſe. For particular directions and cautions to be uſed in preparing it, ſee Mr. Page's account of Ward's medicine.

By this account, the White Drop ſhould ſeem to be a ſolution of mercury in the nitrous acid; but whether that ſolution is effected by the pure acid, or by a nitrous ammoniacal ſalt, overſaturated with the acid, I do not at preſent know; for, in order to determine this queſtion, trials ought to be made to determine whether the nitrous ammoniacal ſalt is capable of diſſolving quickſilver, and of uniting with it into a cryſtallized ſalt; or whether elective attractions have not taken place, and the ſalt produced is not a pure, mercurial, nitrated ſalt.

The obſervations made on this preparation, in Mr. Page's pamphlet, are, that it is extremely mild; and that the doſe of two drops does not contain half a grain of mercury; and the directions given for uſing it are theſe: Take two drops, in a ſmall glaſs of water, in the morning faſting; or at night going to reſt, for two or three days together; then forbear as many days as you take them, and proceed as before, till the courſe is finiſhed. They ſeldom work viſibly; except that, in ſome conſtitutions, they occaſion one or two motions.

The French practitioners are at preſent very much prejudiced againſt the internal uſe of all preparations of mercury, made by diſſolving it in the nitrous acid; alleging, that they are extremely prejudicial to the conſtitution, and that they have ruined the health of many. How juſtly this opinion is founded, I cannot ſay; as nitrous mercurial ſalts have been but ſeldom preſcribed in this country for many years; Ward's Drop having been the only one I know of which has been given; and I have heard it alleged, that bad effects have ſometimes been produced by its uſe; but as the facts did not come under my obſervation, I cannot vouch for the truth of what has been ſaid on that head.

SECT. V.

PREPARATIONS with MARINE, or MURIATIC ACID.

QUICKSILVER unites with the muriatic acid, when it is in a concentrated ſtate; and we have a great many preparations where this acid is conjoined with it.

Mercurius corroſivus ſublimatus albus.

THE corroſive ſublimate, now called by chymiſts *argentum vivum muriatum*, or *hydrargyrus muriatus*, is a ſalt formed by the uniting of quickſilver with the muriatic acid. In preparing it, the quickſilver has been commonly mixed with ſea-ſalt, calcined green vitriol, and nitre; and in the late London Pharmacopoeia it was directed to add likewiſe a ſmall portion of corroſive ſublimate already prepared; and all theſe ingredients were put into a mortar and well mixed by being triturated together; after which they were put into a ſubliming glaſs, ſet in a ſand furnace, and heat applied; the effects of which were, that the quickſilver and muriatic acid, and likewiſe part of the nitrous acid, roſe in form of fumes; and that the quickſilver having a greater affinity with the muriatic acid, than with the nitrous, unites with it and forms the corroſive ſublimate; which attaches itſelf to the inſide of the upper part of the ſubliming glaſs; while the detached nitrous acid, which is very volatile, evaporates or flies off; and the remaining part of the nitrous acid, and the vitriolic acid of the calcined vitriol, remain behind in the bottom of the ſubliming glaſs, united with the alkaline baſis of the ſea ſalt, and of the nitre, and of the calcined vitriol.

Of late the corroſive ſublimate has been made by the following proceſs, which is much more ſimple than the former: Take twenty-four ounces of quickſilver and diſſolve it in an equal weight of the vitriolic acid, and evaporate to dryneſs; then put this vitriolated mercurial calx into a mortar and mix it well with forty-two ounces of ſea ſalt, by triturating them well together; put them into a proper glaſs veſſel ſet in a ſand furnace, and ſublime the corroſive mercurial ſalt: in this proceſs the marine acid and quickſilver riſe on the application of heat; and unite and form the ſalt which attaches itſelf to the upper part of the inſide of the glaſs veſſel, in which they were put, while the vitriolic acid remains behind in the bottom of the veſſel, united to the alkaline baſis of the ſea ſalt.

The corroſive ſublimate is ſoluble in water, and by the account given by Dr. Hope, in a note to page 90 of Dr. Alſton's Materia Medica, publiſhed in 1770, it appears, that an ounce of pure diſtilled water is capable of diſſolving half a dram (thirty grains) of it; but that if the water be firſt ſaturated with ſal ammoniac, its power as a menſtruum is ſo much increaſed, that it becomes capable of diſſolving four drams of the corroſive.

For a long time this preparation of the corroſive ſublimate was believed to be too acrid to be admitted as an internal remedy, and was only employed as an eſcharotic; at laſt, however, ſome bold practitioners uſed it, and acquired reputation from the cures they made. The firſt perſon in this country who mentions its having been given as an internal medicine is Mr. Turner; who ſays, that a quack in London gave it with ſucceſs; but the acrimony of the preparation prevented moſt cautious practitioners from uſing it. About thirty years ago the celebrated Baron Van Swieten recommended a ſolution of it in proof ſpirit, in the proportion of one grain of the ſublimate to two ounces of ſpirit, as an effectual remedy for curing the lues venerea; taken to the quantity of half an ounce of the ſolution twice a day; while the patient drank plentifully of mild diluting liquors, ſuch as decoctions of ſarſaparilla, or of decoctions of the woods, or even of barley-water, or of any other mild liquor. The recommendation of a phyſician in ſo high repute, ſoon made practitioners in every country have recourſe to this remedy: for ſome time every day added to the reputation of this medicine, by the many ſpeedy cures it was thought to have made; an account of which was publiſhed in every periodical work almoſt in Europe; but after ſome time it gradually ſunk in reputation; for many of thoſe patients who were thought to have been cured, had the diſorder appear on them with greater violence than before. Many inſtances came to be known of its diſagreeing with patients; of its occaſioning violent griping pains of the bowels, and bloody ſtools; and of its continued uſe having ruined the conſtitutions of many young people.

I have often ordered it myſelf, and ſeen many others give it to their patients. It certainly often carries off the venereal ſymptoms in a very ſhort time; but after ſix weeks or two months, the diſorder frequently returns again. Whether it would make complete cures if the patients continued to take it long enough, I ſhall not ſay; but it is ſo nauſeous a medicine, that few people can be perſuaded to continue its uſe, after the ſymptoms have diſappeared; and practitioners are cautious of perſiſting too long in the uſe of it, as ſuch courſes have frequently hurt the conſtitution. After ſeeing great quantities of this preparation adminiſtered, I am of opinion, that it is a very good alterative medicine in ſlight caſes, and is often ſerviceable in removing venereal eruptions, and other ſymptoms which ſometimes remain after ſalivation, where mercury has been freely uſed; particularly if a decoction of ſarſaparilla, or other antivenereal decoctions, are given along with it. In ſhort, I think that it is a very uſeful alterative mercurial in many venereal complaints, but not a remedy to be truſted to for the cure of a confirmed pox; and that it is an efficacious remedy for removing ſome eruptive complaints which are not venereal, and in promoting the cure of many foul ulcers; and that it is uſeful in many other complaints, when properly adminiſtered.

Dr. John Gardiner has, in the third volume of the Edinburgh Phyſical and Literary Eſſays, recommended the corroſive ſublimate as a good remedy for the cure of worms. He orders half an ounce of pure water to be ſaturated with ſal ammoniac, and then half a dram of the corroſive ſublimate to be diſſolved in it, and to mix with this liquor as much crumbs of bread as forms a maſs, that is to be divided into 240 pills, which are to be allowed to dry; of theſe pills he directs one or two to be taken morning and evening daily for ſome time; and for the patient to take at times a doſe of ſome opening medicine: and he relates ſeveral caſes of patients who evacuated great quantities of worms of the different ſorts by the uſe of theſe medicines.

Mercurius corroſivus albus fortior.

DOCTOR Hope, in a note to page 90 of Dr. Alſton's Materia Medica, publiſhed in 1770, mentions, that ſome years before a more active corroſive mercury was prepared and uſed at the Hoſpital at Edinburgh, than the common corroſive ſublimate. It was made by precipitating quickſilver from its ſolution in the nitrous acid, by means of the volatile alkali; and then diſſolving this precipitated calx in the muriatic acid, and evaporating this ſolution properly, to allow the metallic ſalt to ſhoot into cryſtals.

He ſays that this ſalt is more active and more ſoluble than the common ſublimate, from having more acid in the compoſition; and that if a grain of it is diſſolved in an ounce of diſtilled water, thirty drops of it becomes a doſe; and that it ſtimulates more powerfully, and produces more violent evacuations by ſweat and by urine than it. However, he obſerves with regard to this, as well as other preparations which ſtimulate much from their acrimony, that they ought not to be employed on every occaſion, and that they are never to be depended upon for making radical cures, as only a very ſmall quantity of mercury can be taken into the blood in that form.

I have never preſcribed this preparation myſelf, nor have I ſeen it given by others, and therefore I can ſay nothing of it from my own experience.

Of late years a number of decoctions, ſyrups, robs, &c. have been prepared in different parts of Europe, and adminiſtered as certain remedies for curing the venereal diſorder; and the people who have ſold them have affirmed that no mercury whatever entered into their compoſitions; and upon their being ſubjected to the common teſts for diſcovering it, no experiment ſhewed that they contained any. This for ſome time was believed to be a proof of the truth of what they aſſerted, till Monſ. Buquet and other chymiſts found on trial, that when a very ſmall quantity of the very active preparations of mercury was intimately mixed with a large quantity of liquor thickened by means of vegetable mucilages and extracts, joined to ſaccharine ſubſtances, particularly honey; it ſo covered the mercurial preparation, that it could neither be known by the taſte, nor by any of the experiments commonly made uſe of to diſcover it. It is ſuſpected that the mercurial preparation employed for making theſe *ſecret medicines*, is either the mercurius corroſivus albus fortior, juſt mentioned, or a ſolution of mercury in the nitrous acid, the ſame as Dr. Ward's white drop, as ſuch very ſmall doſes of them prove active medicines.

Mercurius dulcis ſublimatus.

THIS preparation, now called argentum vivum muriatum mite, or hydrargyrus muriatus mitis, is the common corroſive ſublimate, rendered mild, by being united with as much freſh quickſilver, as its acid will take up.

The common way of effectuating this union has been to mix intimately, by triturating in a mortar, four parts of the corroſive ſublimate, with three or three and a half parts of quickſilver, till the globules of the quickſilver diſappeared; to put them thus mixed into a proper glaſs veſſel, and digeſt them in a ſand heat till they were united; then to increaſe the heat, and keep it up till all the muriated metallic ſalt had ſublimed, and attached itſelf to the upper part of the inſide of the glaſs, and after this to break the glaſs veſſel, and take out the mercurial ſalt which had ſublimed; then after ſeparating from it the acrimonious part at the top, to triturate it in a glaſs mortar, till it is reduced to a fine powder, along with any particles of quickſilver which have not been corroded in this firſt ſublimation, and till they be intimately united with it; after which to repeat the ſublimation three different times more, when the whole of what ſublimes will be found to be the white mercurial ſaline ſubſtance, called *mercurius ſublimatus dulcis*, which has been ſo much uſed in practice.

Formerly it was believed that ſublimation broke and deſtroyed the ſaline ſpiculæ of the corroſive ſublimate, and that therefore the oftener this preparation was ſublimed, the milder it became; and that when it was ſublimed ſeven times, that then it was in the higheſt perfection, and was called, though very improperly, *calomel*, and *aquila alba*; but later experience has ſhewn that it is not the repeated ſublimations, but the union of a freſh quantity of quickſilver, which blunts the acrimony of the ſaline ſpiculæ, and renders the preparation milder: and it has been diſcovered by repeated trials, that after the new additional quantity of quickſilver has been perfectly united, that every ſucceeding ſublimation renders the medicine more acrid, by diſſipating part of the quickſilver, with which it had been before conjoined.

The mercurius ſublimatus dulcis has been the moſt employed of any of the mercurial preparations as an internal remedy.

Small doſes of one or of two grains, given once a day for a number of ſucceſſive days, often acts only as an alterative; but in ſome conſtitutions its continued uſe for a week or ten days, or even ſometimes for four or five, affects the mouth, and brings on a ptyaliſm; to prevent which, its uſe may be intermitted for a day or two after every ſecond or third doſe; or ſome opening medicine may be given occaſionally.

If theſe ſmall doſes are repeated twice or thrice in the day, or if the doſes are increaſed to four or five grains daily, and they do not purge, they generally begin to affect the mouth in four, five, or ſix days;

where it is intended to bring on a ptyaliſm, a ſmall quantity of opium may be added to each doſe of the mercury, to prevent its going off by ſtool.

Two, three, or five grains of this preparation prove purgative to moſt children; as do ſix, eight, or ten, to moſt adults. It is very common to add from one to five grains of it to a doſe of rhubarb, or of jalap, or of other purgative medicines, in order to evacuate worms, or to clear the bowels of children when foul; and to add from five to ſix or eight grains to doſes of purging powders for adults, with the ſame intentions; and in caſes of obſtinate coſtiveneſs I have ſeen no remedies anſwer more effectually than from eight grains to a ſcruple of this preparation, joined to an equal quantity of the extractum catharticum.

Two or three grains given every night at bed-time, or twice in the day, have ſometimes proved powerfully diuretic, in caſes of dropſy; and have carried off all the dropſical waters in a very ſhort time;

ſeveral inſtances of which I have ſeen myſelf, and many are related by authors.

Rubbed with equal parts of the ſulphur auratum antimonii, in a mortar, till they are intimately mixed, it forms an alterative medicine which has been much employed in venereal and in cutaneous diſorders.

In ſhort, this preparation of mercury has been uſed in every caſe almoſt where mercury has been recommended.

Formerly it uſed to be directed to digeſt this medicine in four times its own weight of ſpirit of wine for twenty days together, and to ſhake it frequently during that period, and then to pour off the ſpirit, and dry the powder; when it was called *panacea mercurii*, and was believed to be rendered much milder; but experience has ſhewn that it remains the ſame, and has not been changed by this proceſs.

Mercurius precipitatus albus.

THIS is a preparation entirely of the ſame nature as the preceding, the *mercurius dulcis ſublimatus.* It was formerly much uſed, and the receipt for preparing it inſerted in moſt of the pharmacopoeias in Europe, publiſhed about ſixty or ſeventy years ago, and in Boerhaave's and moſt other books of chymiſtry.

It uſed to be made by diſſolving quickſilver in an equal weight of double aqua fortis (nitrous acid), and then ſeparating it from it, by adding by little and little a ſtrong brine of ſea ſalt, till all the mercury precipitated in form of a very white powder; which was known to have happened, by no more clouds appearing on dropping more of the brine into the ſolution. This white powder or precipitate was then ſeparated and waſhed repeatedly in very hot pure water, till it became quite inſipid, and was dried and kept for uſe.

Boerhaave, in the ſecond volume of his Chymiſtry, where he give the proceſs for making it (proceſs 196), ſays, that this white precipitate, when rightly prepared, is perhaps the beſt mercurial remedy for internal uſe, that is hitherto known.

Since the principles of chymiſtry have been better underſtood it appears to be a preparation entirely of the ſame nature as the ſublimatus dulcis; for on the mixture of the ſtrong brine of ſea ſalt with the ſolution of quickſilver in the nitrous acid, the acid of the ſea ſalt, which has a greater affinity with the mercury than the nitrous acid, immediately attaches itſelf to it, and precipitates with it in form of a white calx, while the nitrous acid unites with the alkaline baſis of the ſea ſalt, and on being evaporated, yields a cubic nitre.

In the year 1778, this *white precipitate* was again introduced into practice, by Mr. Scheele, as a new medicine, under the name of *mercurius muriatus mitis*, with a little variation, though materially the ſame, in the method of preparing it. The directions he has given are, to diſſolve half a pound of quickſilver in an equal quantity of the nitrous acid, by digeſting them for ſome hours in a long-necked matraſs, and ſhaking it from time to time; then to pour very ſlowly this ſolution while hot into a large bowl containing a gallon of hot diſtilled water, in which four ounces and a half of ſea ſalt have been previouſly diſſolved; taking care to keep ſtirring the liquor about with a wooden ſpatula, while the ſolution of the quickſilver is pouring into it; on mixture of the ſolution the liquor becomes turbid and milky, but if let ſtand for ſome hours it lets drop the *white precipitate* to the bottom of the bowl; and the liquor which ſwims at top becomes clear; after which this clear liquor is to be poured off, and ſome boiling diſtilled water is to be poured over the precipitate, and it is to be ſtirred about with the wooden ſpatula as before, and then to be let ſtand till it again drops the precipitate, which is to be ſeparated from it as before; after which it is to be thus repeatedly waſhed till both the laſt water employed and the precipitate itſelf become quite inſipid. Mr. Scheele ſays, that from the quantity of quickſilver here uſed, that he got eight ounces and a half of this *white precipitate*, which he calls *mild muriated mercury*.

Probably the diſſolving the ſea ſalt in ſuch a large quantity of diſtilled water, and the adding to it by degrees the ſolution of the quickſilver in the nitrous acid, may make it much eaſier to prepare this medicine than by the old method of dropping a ſtrong brine of ſea ſalt into the ſaturated ſolution of the quickſilver.

S E C T. VI.

Mercurius acetatus.

ABOUT thirty years ago a practitioner of the name of *Keyſer*, adminiſtered a preparation of mercury at Paris, for the cure of the venereal diſorder, which was ſaid to be more efficacious than any other in uſe: he kept the receipt for making it a ſecret, till the late king of France gave him a ſum of money to diſcover it, when it proved to be the *mercurius calcinatus*, diſſolved in diſtilled vinegar, and made up into pills with manna and flour of wheat.

The acetous acid does not affect quickſilver in its fluid metallic form, but acts upon it after it has been reduced to the ſtate of a calx; either by being expoſed to heat, or by being precipitated by means of alkaline ſalts from its ſolution in the mineral acids. Monſ. Morveau mentions, that on Keyſer's diſcovering the method of making his pills, chymiſts tried a number of experiments to diſcover which were the beſt mercurial preparations for diſſolving in the acetous acid, and found that the *mercurius calcinatus* was amongſt the worſt that could be uſed for that purpoſe, as acetous acid acted with great uncertainty, and very unequally upon it; and that the calx of mercury precipitated from its ſolution in the nitrous acid, and waſhed with hot water, till it was perfectly inſipid, was amongſt the beſt: and he ſays, that a dram of this precipitate diſſolved in two pounds of diſtilled vinegar, by placing it on a ſand heat, and digeſting it for ſome time, and keeping it conſtantly ſtirring, and afterwards evaporating, and filtering it while very hot, and ſetting it by to cool, yields a cryſtallized mercurial ſalt, which is infinitely preferable to Keyſer's pill as an internal remedy for the venereal diſorder.

Many now diſſolve the white precipitate in the concentrated acetous acid, inſtead of the diſtilled vinegar, which ſhortens the proceſs greatly, as the ſolution is much ſtronger and requires leſs evaporation; a formula with the particular directions for preparing this mercurial ſalt, is to be found in the Pharmacopoeia annexed to this work.

There are a great many other preparations of mercury beſides thoſe I have mentioned; but as I have treated of all thoſe in common uſe, I ſhall paſs over them without further notice, and go on to conſider the other ſemimetals.

SECT. VII.

Of Antimony.

ANTIMONIUM, called likewiſe *ſtibium* and *ſtimmi*, in Engliſh antimony, is a hard, heavy, metallic mineral or ſemimetal, compoſed as it were of long ſhining ſlender ſtriæ, or thin and narrow laminæ, rather than needles; of a leaden colour, and ſulphureous ſmell, which is found in its proper mines, as well as thoſe of other metals, eſpecially in lead and ſilver mines, and almoſt in every country.

The ore when taken out of its mines is broke into pieces of the ſize of a walnut, and put into a large crucible with ſome ſmall holes in its bottom, covered and ſet into the mouth of a ſmaller pot, ſunk in aſhes, well luted, and fire put round the crucible till it be red hot; the antimony commonly melts in about half an hour, and runs through the holes in the bottom of the crucible into the pot below; which being of the figure of an inverted cone, gives the antimony the form in which it is brought to market, which is that of a ſugar-loaf.

In this ſtate antimony may be looked upon as a half-purified ore, for it ſtill contains a great deal of ſulphur, and the broad upper part more in proportion than the ſmaller or lower end; for when the melted ore runs down from the crucible into the conical pot below, the heavier metallic or reguline part ſinks to the bottom and coagulates there; from which circumſtance crude antimony, when reduced to a fine powder and given as a medicine, is often very uncertain in its operation; for when the powder has been made of part of the broad upper part of the antimonial loaf, it is often quite inactive and inert; and at other times, when it has been prepared from the lower ſmall end, where there is a great proportion of regulus, it proves both emetic and purgative.

What is called the regulus is the true metal, ſeparated from ſulphur and other impurities with which it is combined while it remained in form of an ore; in this ſtate if taken down into the ſtomach, it proves violently emetic and purgative, and promotes the perſpiration, even when taken in ſmall doſes; but when it is enveloped with ſulphur, as it is in the crude antimony, it is commonly an inactive ſubſtance, and the more it is freed from this ſulphur, the more active it becomes.

The reguline or true metallic part may be ſeparated from the ſulphur of the crude antimony either by ſimple fuſion, or by mixing it with proper fluxes, or ſuch ſubſtances as when expoſed to the fire help to diſſipate part of the ſulphur, and unite with the remaining part, ſo as to allow the regulus of the antimony to ſeparate itſelf from it.

1. The ſulphur is ſeparated in the firſt of theſe ways by ſimply melting the crude antimony, and pouring it while hot into a deep large iron conical veſſel, which becomes narrow at the bottom, and has been heated and its inſide greaſed before the

metal is poured into it; for when the metal has become cool, and is taken out of the conical veſſel, it will be found that the lower narrow end of it is moſtly compoſed of regulus, which by its weight had fallen to the bottom of the veſſel, while the metal remained in a fluid ſtate.

2. But as the regulus is not always obtained ſo pure as it is wanted by ſimple fuſion, it is moſt commonly ſeparated by the aſſiſtance of proper fluxes in the following manner, as recommended by Dr. Boerhaave.

Take of nitre two parts, of crude tartar three parts, of crude antimony four parts, reduce them to a fine powder, and after they are well mixed, throw a ſmall ſpoonful of this powder at a time into a very large crucible placed in a proper furnace, and made red hot; and when that has deflagrated, throw in another; and go on ſo, throwing in ſpoonful after ſpoonful till the whole of the powder is conſumed; taking particular care always to let the deflagration of the one quantity be completely over before another is added. When the deflagration is over, then increaſe the fire, ſhut the door of the furnace, and let the matter remain in fuſion, for half or three quarters of an hour; and, when all ſparkling is over, pour the melted matter, quickly, into an iron cone, which has been previouſly heated and greaſed in the inſide, ſtrike the outſide gently with a hammer, and let it ſtand till it is quite cold; then invert the cone, and take out the antimonial maſs; the upper part of which will be found compoſed of ſcoriæ, and the lower of regulus, which had ſunk to the bottom, while the matter was in a fluid ſtate, and they may be ſeparated from each other by the ſtroke of a hammer.

What happens in this proceſs is, that when the powder, compoſed of the crude antimony, nitre and tartar, is thrown into the red-hot crucible, a great part of the ſulphur of the antimony, united to the inflammable parts of the nitre and tartar, deflagrate with a noiſe; and the alkaline baſis of the nitre, joined to the remaining part of the tartar, which is now converted moſtly to an alkaline ſalt, unites with the remaining part of the ſulphur, and forms a hepar ſulphuris; and when they are melted, with a ſtrong heat, along with the regulus of the antimony, and are poured into a heated iron cone, they being lighter than the reguline part, riſe to the ſurface; while the regulus, by its weight, ſinks to the bottom; and, when let ſtand in a cool place, the ſcoriæ and the regulus concrete in this ſituation, and are eaſily ſeparated from each other, by the ſtroke of a hammer.

The regulus obtained in this way, though it appears to be pure, yet, upon trial, is found not to be ſo; for, if it be again melted with an alkaline ſalt, it affords ſulphureous ſcoriæ; which is a certain proof of its not having been entirely freed of its ſulphur; and accounts for the regulus being ſo brittle, as ſulphur has always this effect upon metals.

Pure antimony (regulus) is acted upon by all the acids.

1. The *vitriolic acid*, with the aſſiſtance of heat, forms a white ſaline maſs with it; and Monſieur Morveau ſays, that by the addition of water, a true ſolution of antimony may be obtained; which, by being

evaporated, yields a white reſiduum; and, on adding to it a fixt alkali, lets drop a white precipitate.

2. The *nitrous acid* attacks the regulus of antimony, and reduces it to a ſort of white calx, which Monſieur Morveau calls a ſpecies of diaphoretic antimony; and he ſeems to think that it rather calcines than diſſolves it; though both Monſieur Monnet and Monſieur Geoffroy have affirmed, that it diſſolves a ſmall part of it.

Dr. Lewis, in his New Diſpenſatory, ſays, that the vitriolic and nitrous acids only corrode the regulus of antimony into a powder; to which they adhere ſo ſlightly as to be ſeparable, in a good meaſure, by water, and totally by fire, leaving the regulus in form of a calx, ſimilar to that prepared by fire alone.

3. The *marine acid*, with the aſſiſtance of a ſtrong heat, diſſolves it, and forms a very corroſive liquor, from which a ramified, flexible, cryſtallized ſalt may be obtained, by evaporating the liquor properly, and afterwards putting it in a cool place, to allow the cryſtals to ſhoot. Dr. Lewis obſerves, that although this acid unites with difficulty with antimony; yet, that

it adheres to it very cloſely, inſomuch as not to be ſeparable by any ablution, nor by fire; for on the application of a ſtrong heat, the regulus riſes along with the acid; and that although the vitriolic and nitrous acids ſeem to unite ſo ſlightly with the regulus, yet that both of them diſlodge the marine, and reduce the corroſive muriated antimony to a calx, ſuch as was before deſcribed.

4. *The vegetable acid* (vinegar), even in the moſt concentrated ſtate, and aſſiſted with a boiling heat, acts but very ſlightly upon the regulus of antimony; for, after they have been digeſted together for ſome time, if the liquor be filtered and evaporated, a very ſmall quantity of ſolid matter is left behind. Vegetable acids, in general, do only ſubſtantially diſſolve a very ſmall pittance of this mineral; yet acid and aceſcent liquors very ſoon extract from it a purgative and emetic quality. But although vinegar, by M. Morveau and M. Monnet's account, has ſo little effect in diſſolving regulus of antimony; yet a watery ſolution of the cryſtals of tartar (another vegetable acid), aſſiſted by heat, act on glaſs of antimony, on the calx precipitated

by an alkaline ſalt from its ſolution in the muriatic acid, and on ſeveral other of its preparations, and diſſolve them in large quantity, as ſhall be taken notice of when I come to treat of emetic tartar.

Having premiſed theſe few things relative to the changes which this ſemimetal undergoes, by fire or acids acting upon it; I ſhall next conſider its general medical virtues and properties, and then the different preparations made with it, which are uſed as medicines, and the effects they produce upon the human body.

The general effects of antimony, in an active ſtate, taken as a medicine, are:—In large quantity, it excites a nauſea and vomiting, and often brings out a plentiful perſpiration and ſweat, and generally ſoon after gives a few looſe ſtools, and ſometimes operates as a violent hydragogue purge. In ſmaller doſes, it produces the ſame effects in a leſs degree. And in ſtill ſmaller, but often repeated, it cauſes a ſmall degree of nauſea, or ſickneſs, without operating as an emetic, and promotes a free perſpiration, at the ſame time that it often operates by ſtool. At other times, it only operates as a diaphoretic.

In ſhort, when properly managed, it is found to promote all the different evacuations, by vomit, by ſtool, by ſweat, and by urine ; though in general, in whatever way it is given, it is apt to excite, more or leſs, ſickneſs and nauſea, or a vomiting, and likewiſe to operate by ſtool ; and from theſe properties, antimony and its preparations have been much uſed in fevers, and in other acute diſeaſes, for giving a ſtimulus to nature, and promoting a diſcharge of the morbid matter, by the different outlets of the body ; and they have been ſtrongly recommended in chronic diſorders, for the removal of obſtructions.

Great variety of the preparations of antimony have been uſed as medicines ; which I ſhall next conſider : but, as in making many of them, it is neceſſary to toaſt and calcine the ore (crude antimony), in order to free it of its ſulphur : I think it may be proper, before treating of each of the preparations ſeparately, once for all, to obſerve,

1. That, in general, the beſt method of

ſeparating the ſulphur is, to reduce the crude antimony to a fine powder; then to put ſo much of it as can conveniently be ſtirred about, into a wide, ſhallow iron pan, ſomewhat reſembling a frying-pan; then to ſet the pan over a gentle fire, and to gradually increaſe the heat, and to keep the powdered antimony in the pan conſtantly ſtirring about, with an iron ſpatula, while any fumes ariſe, and afterwards, ſo long as it is kept over the fire, particularly towards the end of the operation; taking care, during the whole time, never to increaſe the heat ſo much as to melt the antimony, or to allow it to run into lumps; for if it does, the lumps muſt be taken out, and again reduced to a powder.

2. That during the whole time of performing this proceſs, the operator ought to be very careful to avoid drawing in the ſulphureous vapour into his lungs: for ſuch fumes are extremely noxious, and there are inſtances of people's having been ſuffocated by them.

3. That the antimony of the calces, formed by the mere force of fire, is commonly,

if not always, corroded, more or leſs, by the vitriolic acid, which has been diſengaged from the ſulphur during the calcination; and therefore, that ſuch calces may be conſidered as vitriolated.

1. *Crude Antimony.*

CRUDE antimony, as I before obſerved, is a half purified ore. It was formerly recommended as a very valuable and efficacious medicine, and uſed to be finely levigated, and either given in form of a powder, or made up into troches, in rheumatic and in cutaneous diſorders; but it is now ſeldom uſed, on account of the uncertainty of its operation; in general, it proved very unactive, though, at times, it operated as a violent emetic and purgative medicine; owing, probably, to the antimony employed having been taken from the lower ſmall end of the conical loaves; which, as we before obſerved, abound with reguline parts, which ſink by their own weight to the bottom, while the crude antimony is in a fluid ſtate. On theſe accounts, crude antimony is not ſo much uſed as formerly; particularly, ſince other of its preparations have been diſcovered, the doſes and operations of which are more certain. It is, however, much uſed by horſe-jockies, to remove foulneſs from the ſkins of horſes, and to make them ſlick, and grow fat.

The late Dr. Huxham has recommended the following *æthiops*, made with crude antimony, as a moſt efficacious remedy in cutaneous and rheumatic diſorders, and for removing glandular obſtructions: Take three drams of finely levigated crude antimony, four drams of quickſilver, and two drams of flowers of ſulphur; and rub them in a mortar, till the globules of the quickſilver entirely diſappear. The doſe, from ten grains to a dram, twice a day.

2. *Regulus of Antimony.*

THE regulus, or pure antimony, ſeparated from its ore or crude antimony, in the manner already mentioned, or according to the directions given in proceſſes 212 and 213 of Boerhaave's Chymiſtry, and in other books, is very eaſily acted upon by our juices; and proves a ſtrong emetic and purgative medicine, when taken down into the ſtomach. At preſent, it is not uſed, on account of the violence of its operation, though formerly it was given in powder, in doſes of two, ſix, or eight grains; and little balls of it uſed to be caſt in moulds, which were ſtrongly purgative, and were called *pilulæ perpetuales*; becauſe if they were ſwallowed and paſſed by ſtool, and then cleaned and taken as before, and this operation was repeated for fifty or more times, they always proved purgative, and loſt almoſt nothing of their weight. Cups of this metal were likewiſe caſt; which were called *emetic cups*, becauſe wine kept in them for a day or two acquired an emetic quality.

3. *Glaſs of Antimony.*

ANTIMONY may be deprived of its ſulphur, and reduced to the ſtate of a glaſs, by the mere force of fire; for if the powder of crude antimony be put into a very ſhallow, broad iron pan, and be kept over a ſlow fire, and be perpetually ſtirred till all the ſulphureous fumes evaporate, it will be reduced to a grey powder, which is a calx of antimony; and if this grey powder or calx be put into a crucible, and expoſed to a great heat, it melts into a vitreous matter, called *glaſs of antimony*; and the vitrification is known to be completed when an iron wire is dipt into it, and the matter which adheres to the end of the wire appears ſmooth and equally tranſparent; when this is found to be the caſe, the glaſs muſt be poured out upon a hot ſmooth ſtone, or a heated plate of copper, and ſuffered to cool by ſlow degrees, to prevent its cracking, and flying to pieces.

This is a very active preparation of antimony; and, like the regulus, operates ſo violently, that it is ſeldom uſed as a medicine by itſelf, but is kept for making ſeveral other preparations of this metal; ſuch as, the *vitrum ceratum antimonii*, the *tartar emetic*, and the *antimonial wine*.

4. *The cerated Glaſs of Antimony.*

THE glaſs of antimony reduced to the ſtate of a crocus by the addition of one eighth part of its own weight of bees-wax, has been much recommended as a ſpecific in the dyſentery, under the name of *vitrum ceratum antimonii*, or *cerated glaſs of antimony*. It is made in the following manner: Take of yellow bees-wax a dram, melt it in an iron ladle, and then add, by degrees, an ounce of the glaſs of antimony, which has been finely powdered, while it is kept ſtirring about with a ſpatula; let it remain over a gentle fire for half an hour, keeping continually ſtirring it; and then pour it upon a marble, or on paper, and, when it is cold, grind it into powder.

Dr. Young obſerves, that the glaſs melts in the wax with a very gentle heat; that after it has been about twenty minutes on the fire, it begins to change its colour; and in ten more comes near to that of Scotch ſnuff, which is a mark of its being ſufficiently prepared.

In the 5th volume of the Edinburgh Medical Eſſays, there is a number of caſes of diarrhœas and dyſenteries mentioned by Dr. Young and other practitioners, which were cured by the uſe of this medicine, given from three or four to ten or twelve grains.

Dr. Young ſays, that the ordinary doſe for an adult, is from ten to twelve grains; and that to a very ſtrong man he has given a ſcruple: to weakly conſtitutions he has given five or ſix grains; and afterwards increaſed the doſe, according to its operation: to a boy of ten years of age, from three to four grains: to younger patients, from two to three or four grains.

This medicine purges almoſt every perſon, and ſometimes it makes the patient ſick, and vomit; and Dr. Young ſays, that he has known it cure without occaſioning any ſenſible evacuation or ſickneſs.

I have often ſeen this medicine given: it generally operated briſkly, and frequently occaſioned ſickneſs and vomiting. As the mild purges have been found to anſwer better in the dyſentery than thoſe whoſe operation is more violent, it is not given ſo frequently as formerly; though where a briſk purgative medicine is wanted, it may be given with the greateſt ſafety.

Dr. Geoffroy, in his Materia Medica, mentions a preparation of the glaſs of antimony, which is ſomewhat ſimilar to this.

He ſays, that if fine levigated glaſs of antimony be digeſted in a ſpirituous tincture of gum maſtich for three days, and the ſpirit be then all evaporated, that the reſiduum proves to be a medicine which operates by ſtool, but does not vomit.

5. *Antimony calcined with Hartſhorn.*

IT is long ſince antimony calcined with hartſhorn has been uſed as a medicine; for in Poterius's Works, publiſhed by Hoffman, A. D. 1698, it is mentioned, that antimony burnt with hartſhorn in a reverberatory furnace, loſes its virulency, and becomes a diaphoretic and alexipharmic medicine.

A powder of this kind has been for ſome time in uſe; and is prepared in the following manner: Take two pounds of ſhavings of hartſhorn, that has been well dried and reduced to a groſs powder, and as much powdered crude antimony; mix them together, and put them into a wide, ſhallow, iron pan, over the fire, and keep them perpetually ſtirring for ſome hours, till no more ſulphureous vapours ariſe, and the whole has acquired a grey colour; then remove the iron pan from the fire, and when the burnt matter is cool, reduce it to a fine powder, by triturating it in a mortar, and put it into a coated crucible, and put over it a crucible of the ſame ſize, inverted, with a hole in the bottom of it; then place the crucible in a proper furnace, lute the two crucibles together, light the fire, and keep the crucible expoſed to a very ſtrong heat for two hours, or till what are called the ſilver flowers of antimony begin to riſe; then take the crucible out of the fire, and when the calcined matter is cool, reduce it to a fine powder; which keep for uſe.

This powder, if rightly prepared, is of a white colour. It is a mild antimonial preparation; it is given from three to ſix or ſeven grains as an alterative; and it ſometimes creates a nauſea, and even vomits: in larger doſes it proves emetic, and ſometimes operates by ſtool.

This ſhould ſeem to be a vitriolated calx of antimony, rendered mild by an additional quantity of phlogiſton, and a mixture of calcined animal earth.

6. *Dr. James's Powder.*

A POWDER ſimilar, if not entirely the ſame, has long been uſed, under the name of Dr. James's Powder. The following is a copy of the receipt for making it, extracted from the Records of Chancery; the Doctor, when he took out a patent for ſelling his powder, having ſworn, in the moſt ſolemn manner, that it was the true and genuine receipt for preparing it.

Take antimony, calcine it with a continued protracted heat, in a flat, unglazed, earthen veſſel, adding to it, from time to time, a ſufficient quantity of any animal oil and ſalt, well dephlegmated; then boil it in melted nitre for a conſiderable time, and ſeparate the powder from the nitre, by diſſolving it in water.

When the Doctor firſt adminiſtered his powder, he uſed to join one grain of the following mercurial preparation to thirty grains of his antimonial powder; but in the latter part of his life he often declared, that he had long laid aſide the addition of the mercurial. His mercurial, which he called a pill, appears, by the Records of Chancery, to have been made in the following manner: Purify quickſilver, by diſtilling it nine times from an amalgam, made with martial regulus of antimony, and a proportional quantity of ſal ammoniac; diſſolve this purified quickſilver in ſpirit of nitre, evaporate to dryneſs, calcine the powder till it becomes of a gold colour; burn ſpirits of wine upon it, and keep it for uſe. Dr. James, at the end of the receipt given into Chancery, ſays, "The doſe of theſe medicines is uncertain; but in general thirty grains of the antimonial and one grain of the mercurial is a moderate doſe. Signed and ſworn to, by *Robert James.*"

I have frequently directed this powder to be given, and have often ſeen Dr. James himſelf, as well as other practitioners, adminiſter it, in fevers, and in other complaints. Like other active preparations of antimony, it ſometimes operates with great violence, even when given in ſmall doſes; at other times, a large doſe produces very little viſible effects. I have ſeen three grains operate briſkly, both upwards and downwards; and I was once called to a patient to whom Dr. James had himſelf given five grains of it, and it purged and vomited the lady for twenty-four hours, and in that time gave her between twenty and thirty ſtools; at other times I have ſeen a ſcruple produce little or no viſible effect.

So far as I have obſerved, I think that the doſe of this powder, to an adult, is from five to twenty grains; and that when it is adminiſtered, that one ought to begin by giving ſmall doſes.

Where patients are ſtrong, and a free evacuation is wanted, this is a uſeful remedy; and it may be given in ſmall repeated doſes, as an alterative, in many caſes; but where patients are weakly and in low fevers, it often acts with too great violence; and I have myſelf ſeen inſtances, and have heard of others from other practitioners, where patients have been hurried to their graves by the uſe of this powder, in a very ſhort time.

It has been called Dr. James's Fever Powder, and many have believed it to be a certain remedy for fevers; and that Dr. James had cured moſt of the patients whom he attended and who recovered, by the uſe of this powder; but the bark, and not the antimonial powder, was the remedy which Dr. James almoſt always truſted to for the cure of fevers; he gave his powders only to clear the ſtomach and bowels; and after he had effected that, he poured in the bark as freely as the patient could ſwallow it. The Doctor believed all fevers to be more or leſs of the intermitting kind, and that if there was a poſſibility of curing a fever, that the bark was the remedy to effectuate the cure; for if the fever did not yield to that, he was ſure that it would yield to no other remedy whatever, as he has more than once declared to me when I have attended patients in fevers along with him.

A medicine which operates nearly in the ſame manner, as theſe two laſt named preparations, is the antimonial powder of St. George's Hoſpital, which is compoſed of one part of emetic tartar, and eleven of the calx of antimony.

As crude antimony is ſo inactive a medicine, owing to the quantity of ſulphur it contains, and as the regulus is too violent, from having been freed of moſt of its ſulphur, practitioners have endeavoured to make preparations of an intermediate degree of ſtrength between theſe two, which ſhould act mildly and with certainty; and as they found that by deflagrating antimony with nitre, they could free the antimony of more or leſs of its ſulphur, according to the quantity of nitre they employed, they have made a number of antimonial preparations of different degrees of ſtrength, to anſwer the various purpoſes for which antimony may be employed as a medicine.

7. *The Medicinal Regulus of Antimony.*

IF one part of nitre be mixed with eight parts of powdered crude antimony, and be reduced to a powder by triturating them together in a mortar, and be then deflagrated by throwing the powder by little and little into a red-hot crucible, they form what is called the *regulus medicinalis*; a medicine which is in great repute in Germany. It is a mild preparation, but much more active than the crude antimony, for fifteen or twenty grains of it prove emetic and purgative: in ſmaller doſes it promotes the watery ſecretions by the ſkin and the kidneys; though ſometimes theſe ſmall doſes operate both as an emetic and purgative, when they either meet with an acid in the ſtomach or bowels, or the ſtomach is in a very irritable ſtate.

8. *The Saffron, or Liver of Antimony.*

IF equal parts of powdered crude antimony and of nitre be uſed, then the greater part of the ſulphur is evaporated, and it becomes a very ſtrong active medicine, approaching to the regulus in its nature, and in the effects it produces on the human body. It has commonly gone by the names of *crocus antimonii*, or of *crocus metallorum*, and ſometimes of *hepar antimonii*, on account of its colour. It has been given from two to five or ſix grains as an emetic and a purge; but it is ſometimes ſo violent in its operation, that it is now ſeldom uſed as a medicine by itſelf, but is kept for making other antimonial preparations.

9. *Mild Emetic Antimony.*

IF two parts of nitre are mixed and deflagrated with one part of powdered crude antimony, the produce is a white powder, which Boerhaave has called *antimonii emeticum mitius.* The quantity of nitre employed in this proceſs being greater than is ſufficient to carry off the ſulphur of the crude antimony, not only cauſes it to evaporate, but acts likewiſe on the regulus, and reduces it in part to the ſtate of a calx, which Boerhaave ſays is of a mild nature, and excites nauſea and gentle vomiting, attended with a free diſcharge of ſaliva and of thick urine.

10. *Calx of Antimony, commonly called Diaphoretic Antimony.*

IF three parts of nitre are deflagrated with one of antimony, the quantity of nitre is ſo great as not only to carry off all the ſulphur, but to reduce likewiſe the regulus to an inert calx, which formerly went by the name of *diaphoretic antimony*, but is now commonly called *calx of antimony*. This was formerly looked upon as a very powerful diaphoretic medicine, and was given from five grains to half a dram, in a variety of diſorders: in general it has no ſenſible operation, yet ſome practitioners have imagined that they have ſeen good effects produced from its uſe.

The hepar ſulphuris, or ſulphur united to an alkaline ſalt, acts more or leſs upon moſt metallic ſubſtances; and ſulphur precipitated from its hepar impregnated with antimony, has been uſed under the names of *ſulphur of antimony*, and of *kermes mineral*.

11. *Precipitated Sulphur of Antimony*.

THIS may be prepared in different ways; the following is the moſt ſimple.

Take twelve ounces of crude antimony reduced to a powder, boil them in four pints of ſoap ley, mixed with two pints of diſtilled water, for two or three hours; ſtirring the liquor conſtantly about with an iron ſpatula, and adding diſtilled water as there may be occaſion; then ſtrain the liquor through a folded cloth, and while it is yet hot add as much nitrous or other acid, as will precipitate all the ſulphur; let the liquor ſtand for ſome hours till the ſulphur has ſunk to the bottom, then ſeparate it, and waſh it in diſtilled water.

The moſt common way to prepare this ſulphur has been, to boil the ſcoriæ which remain after ſeparating the regulus from crude antimony, by deflagrating it with tartar and nitre as was formerly mentioned, in a ſufficient quantity of diſtilled water, till all the hepar ſulphuris was diſſolved; then to filter the water through paper, and precipitate the ſulphur by adding the nitrous or any other acid, and afterwards to ſeparate and waſh the precipitated ſulphur.

The ſulphur precipitated in either of theſe ways has been called in the London Diſpenſatory *ſulphur antimonii præcipitatum*, and in other books, *ſulphur auratum antimonii.* The ſtrength of this medicine is very uncertain, for it depends entirely on the quantity of reguline parts it contains; often it contains ſo little that it may be given in large doſes, at other times a few grains act very powerfully.

The cauſe of the ſulphur precipitating from the water in which its hepar was diſſolved, on the addition of an acid, is this; that the acid having a greater affinity with the alkaline ſalt of the hepar, than the ſulphur, it immediately unites with it; and the water being no longer able to ſuſpend the ſulphur, lets it drop, and remains impregnated with the neutral ſalt formed by the alkali of the hepar, and the acid added to precipitate the ſulphur; which may be ſeparated from it by filtering the water through paper, evaporating it, and cryſtallizing the ſalt; or by evaporating to dryneſs.

12. *Kermes Mineral.*

A Medicine a good deal ſimilar to the laſt, is prepared by boiling twelve ounces of crude antimony powdered, in four ounces of ſoap ley, and four pints of diſtilled water, for two hours; and then immediately while it is yet hot ſtraining it through a folded cloth of a cloſe texture, and ſetting it in a cool place, when it will drop a grey reddiſh powder, which has got its name from the likeneſs of its colour to the alkermes, or grana kermes: it has been called by late chymiſts *ſulphur antimonii præcipitatum per ſe*, and *ſulphur antimonii alkaliſatum*. The preparation of this powder was formerly kept a ſecret in France; and it was then as much run after there, as ever James's powder was in England: but the receipt for preparing it having been made public, it degenerated into a common antimonial medicine. In ſmall doſes of one, two, or three grains it is given as an alterative to promote the watery ſecretions; in large doſes, like the other reguline preparations, to vomit and purge.

13. *Cinnabar of Antimony.*

FORMERLY a cinnabar ſublimed, with the addition of ſome of the reguline preparations of antimony, was in great repute. It may be made in different ways, either,

1. By melting five ounces of flowers of ſulphur, and adding to it by degrees forty ounces of quickſilver, ſo as to form an æthiops mineral, and then when it is cold mixing intimately with it, by triturating in a mortar, three ounces of crude antimony, and putting the mixed powder into a proper veſſel and ſubliming it.

2. Or by rubbing in a mortar eight ounces of ſulphur of antimony with forty ounces of quickſilver, till all the globules of the quickſilver perfectly diſappeared, and then ſubliming in a proper veſſel to form a cinnabar.

3. Or by putting into a proper glaſs, and ſubliming the matter which remains in the retort after the *butter of antimony,* called now the *antimonium muriatum,* has been diſtilled in it, from a mixture of corroſive ſublimate and crude antimony.

Cinnabar, thus made, is generally an inactive medicine, though ſometimes it contains a ſmall portion of regulus, and acts like a mild antimonial preparation.

There are likewiſe a number of preparations made with antimony, either corroded or diſſolved by acids, which have been uſed.

14. *Purging, or Cathartic Antimony.*

VITRIOLIC Acid. The antimonium catharticum, is the only preparation now in uſe where antimony is corroded by the addition of the vitriolic acid. It is made in the following manner:

Put four ounces of glaſs of antimony finely powdered into a retort, and pour gradually over them twelve ounces of the vitriolic acid; diſtil off all the liquor, and waſh the powder which remains in the bottom of the retort till all its acrimony is loſt; then dry it and grind it with an equal weight of Glauber's ſalt, and a double quantity of tartarus vitriolatus; put the mixture into a crucible, which place in a wind furnace, and let this matter be kept for a quarter of an hour in gentle fuſion in a crucible, and afterwards pulveriſed, waſhed, and dried for uſe.

Mr. Wilſon, who is the inventor of this powder, ſays in his Chymiſtry, that this is the moſt certain antimonial purge he ever met with; that it operates without nauſeating the ſtomach, and that the doſe is from two grains to half a ſcruple.

Mr. Rudings, one of the ſurgeons to the army, who practiſed ten or twelve years in the Weſt Indies, told me that he had found the following medicine to be one of the beſt he ever tried for cleanſing the bowels of bilious matter in the intermitting fever of theſe climates: Mix two grains of the cathartic antimony with a grain of tartar emetic, rub them well together in a glaſs mortar, and let the patient, if a ſtrong adult, take this for a doſe early in the morning; but if the patient is a young perſon, or of a weakly conſtitution, let him take only half of this powder at a time, and the other half in two hours after.

Nitrous acid. Monſ. Morveau obſerves, that the nitrous acid rather calcines than diſſolves the regulus of antimony, and reduces it to the ſtate of a white calx, which is a ſort of a diaphoretic antimony: it is an acrid ſubſtance, and neither it, nor any preparations made from it, have ever been uſed for medicines, that ever I have heard of.

15. *Antimoniated Nitre.*

THE ſalt called *nitrum ſtibiatum*, is a ſal polychreſt, which retains a ſmall portion of the reguline part of antimony, and not a nitre. It is made by deflagrating ſulphur of antimony, inſtead of plain ſulphur, with nitre; and then diſſolving the ſalt in diſtilled water, filtering the ſolution through paper, and either evaporating to dryneſs, or cryſtallizing the ſalt. Or it may be made by boiling the ſcoriæ which remain after crude antimony has been deflagrated with nitre, for ſeparating the regulus, in diſtilled water; then filtering the water, and evaporating it to allow the ſalt to ſhoot into cryſtals; or evaporating to dryneſs.

This has been recommended as a cooling diaphoretic and opening medicine.

16. *Cauſtic Antimony.*

MURIATIC, or Marine Acid. A ſolution of antimony in the muriatic acid has been long in uſe, under the name of *cauſticum antimoniale*, or *butyrum antimonii*, and was called cauſtic on account of its acrimony; and butter from its coming over into the receiver when diſtilled, in form of a thick matter, which has ſomething the appearance of butter; it may be called *antimonium in acido muriatico ſolutum.*

The way in which it was formerly made was this: Take a pound of crude antimony and two pounds of common corroſive ſublimate, both reduced to a fine powder; mix them well together in a mortar, taking care to avoid the fumes which may ariſe, and then put them into a wide-necked coated retort, and having luted a proper receiver to it, diſtil. At firſt there comes over a dewy vapour, and then an oily-like matter aſcends and congeals in the neck of the retort, which is either to be melted down by a live coal cautiouſly applied to the outſide, or by admitting air, which makes it run into a liquor and get over into the receiver. Some people order this oily matter to be rectified by diſtilling it again in a retort.

In performing this operation, and in unluting the veſſels, Boerhaave adviſes the operator to be very cautious and avoid the fumes, which are extremely noxious to the lungs.

In this proceſs, the muriatic acid of the corroſive ſublimate unites and riſes along with the reguline parts of the antimony, and forms the oily-like matter called butter, or cauſtic, which on examination proves to be a true ſolution of the regulus in the muriatic acid; and the ſulphur of the crude antimony remains behind in the retort united with the quickſilver of the corroſive ſublimate, in form of an *antimoniated æthiops mineral*, which by being ſublimed affords the cinnabar of antimony.

The cauſticum antimoniale has of late been made in the following manner:

Take of well dried ſea ſalt two pounds, a pound of crocus of antimony, and the ſame quantity of the vitriolic acid; put the vitriolic acid into a coated glaſs retort, then by degrees add the other ingredients; lute on a receiver, and diſtil; when the cauſtic antimony or ſolution of the regulus in the muriatic acid will riſe in form of a thick oily matter, as before, and a Glauber's ſalt, formed of the vitriolic acid united to the foſſil alkali, will remain behind in the retort; which may be diſſolved in diſtilled water, the water evaporated, and the ſalt cryſtallized.

This preparation of antimony is too acrid for internal uſe; it was formerly employed as a cauſtic for eating away the proud or fungous fleſh of ſores, but it is never now uſed for that purpoſe.

17. *Muriated Calx of Antimony, or Mercurius Vitæ.*

IF the butter of antimony, or ſolution of the regulus in the muriatic acid, be thrown into pure water, or into a watery ſolution of the vegetable alkali, the regulus corroded by the muriatic acid immediately precipitates in form of a white powder, which was formerly called *mercurius vitæ,* though it does not contain a particle of mercury; and *angelic powder.* In France it goes by the name of poudre d'Algorotti, from an Italian phyſician who made much uſe of it. It is a violent emetic and purgative preparation of antimony, and has been given in lethargic, apoplectic, and epileptic caſes, from two to ſix grains; but, on account of the violence of its operation, it is now never uſed as a medicine by itſelf, but is kept in moſt countries in Europe, and at preſent is more frequently employed for making emetic tartar, than any other antimonial preparation.

Vegetable acids. The principal ſubſtances containing the vegetable acid, which have been employed for making antimonial preparations with, are *wine*, and *cryſtals of tartar.*

18. *Antimonial Wine.*

WINES diſſolve ſubſtantially a very ſmall pittance of ſolid antimonial preparations, but they acquire a purgative and emetic quality when the crocus or glaſs of antimony, or any of the other very active preparations, have been infuſed in them for ſome days.

The common method of making antimonial wine is, to put an ounce either of the crocus, or vitrum antimonii reduced to a fine powder, into a double quart bottle, and to pour over it a pint and a half of ſherry, Madeira, or old Rheniſh wine; to let the bottle ſtand in a cool place for a fortnight, taking care to ſhake it well once or twice a day; and then, after letting it ſtand without moving for twenty-four hours, to pour off the wine, and filter it through paper, and keep it for uſe. At preſent the antimonial wine uſed in London is made with the glaſs of antimony, and ſherry wine.

This wine is given in ſmall repeated doſes from ten to ſixty or ſeventy drops, for promoting the ſecretions; it generally ſits eaſy on the ſtomach; though ſometimes it creates a ſickneſs and nauſea, or vomiting, when taken above twenty or thirty drops: when given from one to two drams at a time, it for the moſt part creates a nauſea, vomits gently, and frequently gives looſe ſtools, and promotes perſpiration: when given from two drams to an ounce and a half, it operates freely as an emetic, purges, and brings out a ſweat. Dr. *Huxham* ſays of it, " from ten to fifty or ſixty drops it is an attenuant, alterative, diaphoretic, and diuretic; a few more gently purge; and every one knows that a large doſe ſtrongly vomits. What will any one preparation of antimony do more?" Dr. *George Armſtrong*, in his Treatiſe on the Diſeaſes of Children, recommends this wine as an excellent remedy for clearing the ſtomach and bowels: he ſays, that from five to ten drops proves an emetic to children in the firſt month; and from ten to twenty, to children from three months to two years of age. Antimonial vomits are thought to be more uſeful on many occaſions in removing obſtinate obſtructions in dropſies, aſthmas, and many other chronic diſorders, than ipecacuanha, ſquills, or other milder emetics, as they promote all the different ſecretions more powerfully, at the ſame time that they act as emetics. Opium joined to this wine, and indeed to all antimonial preparations, increaſes their diaphoretic powers. I know no better diaphoretic medicine than a mixture of three parts of antimonial wine with one of the tinctura thebaica; given to an adult perſon while in bed from fifty to one hundred and fifty drops, along with weak warm liquors ; it generally proves a powerful ſudorific, and is an extremely uſeful remedy in rheumatic and other complaints where ſweating is wanted.

19. *Emetic Tartar.*

THIS is a metallic ſalt, prepared by diſſolving antimony in a watery ſolution of cryſtals of tartar, till the acid is fully ſaturated with the metal ; and then evaporating the water ſufficiently to allow the metallic ſalt to concrete into cryſtals. By the preſent mode of naming compound medicines, according to their contents, this ſhould properly be called *acidum tartari antimoniatum.*

A medicine under the name of *emetic tartar* has long been uſed in moſt countries of Europe, but different methods have been employed for preparing it. In one place they have made uſe of one preparation, in another of another ; though in general the *crocus* and *glaſs* of antimony have been preferred to the others ; and they have differed likewiſe in the proportional quantity of cryſtals of tartar and of water which they have made uſe of; by which means this medicine has been found to be of very different degrees of ſtrength, in different places where it has been prepared; inſomuch that three grains of one emetic tartar has been found to be equal in ſtrength to ſix or ſeven grains of another.

In order to remedy theſe inconveniences as much as poſſible, phyſicians have ordered a certain quantity of cryſtals of tartar to be diſſolved in boiling diſtilled water, and then to add by degrees, while the ſolution is ſtill on the fire, a quantity either of the crocus or of the glaſs of antimony in powder, equal to that of cryſtals of tartar; and when the liquor is reduced to one-half, to ſtrain it through a cloth, and to filter it through paper; and to put it again on a ſand heat in a glaſs or ſtone veſſel, and evaporate till a pellicle appears on the ſurface; and then to ſet it in a cool place for a night, that the cryſtals may ſhoot, and in the morning to ſeparate them from the liquor, to evaporate the liquor again, and afterwards a third time, and until it yields no more cryſtals; then to mix the products of the different cryſtallizations after they are quite dry, and reduce them to a fine powder. If the crocus or glaſs of antimony and the cryſtals of tartar uſed have been good, and the operation has been performed with care, the emetic tartar will be good, and will be always nearly of the ſame ſtrength; for the cryſtals of tartar will always be fully ſaturated with the antimony; for by experiments made at Apothecaries Hall, A. D. 1786, it appeared that cryſtals of tartar diſſolved in boiling diſtilled water, take up two-thirds of their own weight of the powder of well prepared glaſs of antimony, and are thereby ſaturated with it: and as equal parts of antimony and of cryſtals of tartar are ordered to be employed in the above proceſs, there muſt always be more than ſufficient to ſaturate the acid of the tartar; and the ſuperfluous undiſſolved quantity is ſeparated when the liquor is ſtrained through a cloth, and filtered afterwards through paper.

Of late it has been propoſed to make the emetic tartar with the antimonium muriatum, or white calx of antimony precipitated from its ſolution in the marine acid (called butyrum antimonii), by means of an alkaline ley; and the reaſon given for the preference of this preparation to the crocus or glaſs of antimony, is, that it has been proved by experiments that the cryſtals of tartar only act readily upon the preparations of antimony, which contain a certain portion of phlogiſton; and as no method has hitherto been diſcovered of preparing the crocus and the glaſs of antimony, ſo that they ſhould be at all times equally impregnated with phlogiſton, the modern chymiſts, Sir Torbern Bergman, Mr. Scheele, Monſ. Laſonne, Dr. Morveau, and others, have all recommended that the tartar emetic ſhould be prepared with the calx precipitated from the antimonium muriatum, as being an imperfect calx of antimony, which at all times is equally impregnated with phlogiſton; and is readily acted upon by the acid of tartar; and makes an emetic tartar that is always of the ſame ſtrength. Sir Torbern Bergman recommended the calx precipitated by ſimple water, as being leſs liable to variation; but in general the calx precipitated by an alkaline ley is preferred, as being more freed of the muriatic acid, and of courſe being milder.

If the tartar emetic is prepared with the *antimonium muriatum*, or with the *crocus*, or with the *glaſs* of antimony, experiments ought to be made to aſcertain the quantity of the preparation to be uſed, which the cryſtals of tartar in boiling water are capable of taking up; and the quantity of the antimonial uſed, ought always to be ſome drams more than is abſolutely neceſſary, ſo as to make it at all times certain that the acid of the tartar is fully ſaturated with the metallic or active part of the antimony.

Some chymiſts of late have doubted whether or not the vitrum antimonii, which is tranſparent and brittle, and anſwers to all the other teſts of its being good, is not as certain and proper a preparation as the antimonium muriatum; proper experiments can only determine this queſtion; but in the mean time the authority of ſo many great chymiſts, ſhould incline us to give the preference to the antimonium muriatum, till further experiments have been made to put this matter beyond a doubt. Probably, on trial, the *crocus*, the *glaſs*, and the *antimonium muriatum*, may be found to anſwer equally well if properly managed; and all of them to produce a tartar emetic of the ſame degree of ſtrength.

Sir Torbern Bergman has propoſed to make the emetic tartar with five ounces of cryſtals of tartar, and only two drams and a half of the antimonium muriatum precipitated with pure water; but from the experiments made at Apothecaries Hall, it is evident, that the quantity of the antimonial is greatly too ſmall. Dr. Morveau takes equal parts of cryſtals of tartar and of the antimonial, precipitated with an alkaline ley, and ſays, that the tartar emetic made in this way was always of an equal ſtrength and vomited freely without hurting the ſtomach or bowels; and that three grains was a doſe for an adult perſon. If three ounces of the cryſtals of tartar take up only two of the antimonial, then two ounces and a half of it will be ſufficient.

The emetic tartar has of late been the moſt employed of any of the antimonial preparations.

When it is given with an intention of vomiting freely, and of procuring ſtools, the doſe is from one grain to five, according to the age and ſtrength of the patient. It may be given either by itſelf, or mixed with conſerve in form of a pill, or diſſolved in pure water; and it is no uncommon thing to mix one, two, or three grains of it with ten grains or a ſcruple of ipecacuanha for a vomit.

When it is given in ſmall doſes it is commonly diſſolved in water, in the proportion of one grain to an ounce or two ounces of water; ſo that it may be given in doſes from one-ſixteenth to any other fraction of a grain above that: in ſmall often repeated doſes it promotes perſpiration, and the other ſecretions; and ſometimes it creates a nauſea or operates by ſtool, and ſometimes it pukes gently.

Joined to opiates it acts powerfully as a diaphoretic, and often brings out profuſe ſweats. Joined to purgative medicines it often operates by ſtool, without occaſioning nauſea or vomiting, though it ſometimes excites both; the French uſe it much in this way, and give it along with purging ſalts, or with ptiſans made with manna and tamarinds, or with lenitive electuary, or other opening medicines; and they ſay that in this way it may be given in repeated ſmall doſes the length of eight or ten grains, when we wiſh that it ſhould purge freely.

20. *Antimoniated Tartarus tartariſatus.*

SIR T. Bergman has propoſed to make a kind of emetic tartar by diſſolving three drams of the muriated antimony in a ſolution of ten ounces of cryſtals of tartar; which he thinks will operate more by ſtool than as an emetic; but he does not ſeem to have had experience of the effects of this preparation.

Having thus given an account of the antimonial preparations which have been moſt uſed, I ſhall conclude what I have to ſay of them with obſerving,

1. That the ſolid preparations of antimony made without the aſſiſtance of acids, are ſtrong in proportion to the quantity of ſulphur evaporated without affecting the reguline part; but that if in evaporating the ſulphur the reguline part is acted upon, that they become weaker in proportion as the regulus is affected and reduced to the ſtate of a calx; and hence it is extremely difficult to make ſuch preparations always of the ſame ſtrength.

2. That the preparations made with mineral acids are too rough to be employed for internal uſe by themſelves; but when they are rendered milder by foreign mixture, they become the baſis of ſeveral uſeful medicines.

3. That the antimonials prepared with the vegetable acids, the *antimonial wine*, and the *emetic tartar*, poſſeſs all the virtues of the other antimonial medicines, and can be made do whatever they do; being more certain in their doſes and effects, and never varying in their action from a difference

in the food taken; being already ſo diſſolved and opened by a proper menſtruum as to make them nearly of an equal ſtrength at all times.

Antimony was known to the ancients, and was called by them ſtimmi or ſtibium; they uſed it as a drying and aſtringent external application, eſpecially to the eyes, and they employed it as a paint; but they knew nothing of its uſe as an internal remedy. The famous *Baſil Valentine*, who wrote the Currus Triumphalis Antimonii, and who lived ſome time about the year 1500, was the firſt who ſeems to have made the world acquainted with its virtues and properties, and to have preſcribed it as a medicine. The violent effects produced by ſome of its preparations ſoon prejudiced many people againſt its uſe, and made it be looked on as a poiſon, inſomuch that in the year 1566, by a decree of the faculty of Paris, backed by an arret of parliament, antimony and its preparations were declared to be poiſons; and it was prohibited to be adminiſtered in France. However, ſome people continued to uſe it, and its effects being better known, it was, in the year 1637, permitted by an arret of parliament to be adminiſtered by phyſicians, and by them only, as a medicine. And in the year 1650, the interdiction of 1566 was taken off; and ſince that time it has been permitted to every body to uſe it at pleaſure.

SECT. VIII.

Of ZINC.

Lapis Calaminaris and Tutia.

LAPIS Calaminaris is a brown yellowiſh metallic ſubſtance, which has long been employed as a drying external application, and for mixing with ointments and plaſters; but it was not certainly known what it was till about forty years ago, that Mr. Marggraff, in a paper which was publiſhed in the Memoirs of the Royal Academy of Berlin, proved that it was the proper ore of zinc, and gave an account of the method of ſeparating zinc from it. It is found plentifully in England, Germany, and in other countries, either in diſtinct mines, or mixed with the ores of other metals. It is generally roaſted or calcined to purify it, and render it more eaſy to reduce it to a fine impalpable powder, in which ſtate it is commonly kept. It is only uſed as an external drying remedy; it is ſometimes ſprinkled on ſores to dry and heal them, and at other times to keep down proud fleſh ſprouting from them. It is frequently mixed with collyria, and with ointments and cerates, and an ointment, called unguentum e lapide calaminari, is ordered in moſt diſpenſatories, which uſed formerly to be called Turner's cerate.

Tutia. Hitherto the true nature of this ſubſtance does not ſeem to have been ſo exactly determined as to aſcertain whether it is an impure ſublimate of zinc, or an argillaceous earth ſtrongly impregnated with it. Dr. Lewis ſays, that when zinc is ſublimed, the tutty is got in the upper part of the furnace uſed, adhering to certain cylindrical bodies placed to receive it, and that from them it acquires a tubulated form. It is a hard ponderous ſubſtance, of a browniſh, yellowiſh colour, mixed with pieces which have a blueiſh caſt, from ſome minute particles of zinc being thrown up by the heat, in its metallic form. It is full of ſmall protuberances on the outſide, and is yellowiſh within; it is kept in form of a fine impalpable powder, and is uſed in the ſame manner for external application as the *lapis calaminaris.*

Zinc, zincum, is a heavy white metallic ſubſtance, reſembling lead in its colour. It does not ſeem to have been known to the ancients, nor even to the Arabians. Albertus Magnus, who died in the year 1280, is the firſt who mentions it particularly. It ſhould ſeem that the firſt ſpecimens of it were brought into this country from the Eaſt-Indies, in the laſt century. For ſome time it was not known from whence it came. In the year 1720, *Henkel*

kel mentions, that it may be got from lapis calaminaris: ſince then, mineral ſubſtances which yield it have been diſcovered in many countries; and it is now known that lapis calaminaris is its proper ore, and mines of it have been found in ſeveral parts of England, in Sweden, in Germany, and in other countries: and in the year 1746, Mr. Marggraff publiſhed an account of the method of ſeparating it from its ore, in the Memoirs of the Royal Academy at Berlin, which has ſince been republiſhed by Macquer, and other chymiſts, with obſervations and remarks; by all which it appears, that zinc is a particular volatile metallic ſubſtance, which riſes on the application of heat, and is ſeparated from its ore by being ſublimed in proper furnaces.

The zinc itſelf is not uſed medicinally. If it is the tutenag, as it is called in the Practical Courſe of Chymiſtry, publiſhed by Dr. Lewis in 1746, it is employed for making grates, candleſticks, and a great many other houſehold utenſils.

The zinc is a particular metallic ſubſtance different from all others; for if thrown into the fire, or into a red-hot crucible, and air is admitted, it flames and ſublimes into flowers; but if it be put into a crucible, and another inverted cloſe one be luted above it, it ſublimes in a metallic form. It is ſoluble in all the acids; with the vitriolic it forms the white vitriol which is uſed in the ſhops; with the *nitrous* and *muriatic* acids it forms metallic ſalts, too acrid to be employed medicinally; with diſtilled vinegar it forms a tranſparent ſalt, which has not as yet been tried in the cure of diſeaſes.

Flowers of Zinc.

Flores zinci, flowers of zinc. I have already mentioned, that the zinc contains ſuch a large portion of phlogiſton, that when it is expoſed to a certain degree of heat it flames, and riſes into flowers; which may be collected in the following manner:

Place a large deep crucible in a reclined ſituation, half upright in a furnace; and when the bottom becomes red hot, throw into it two or three drams of zinc, which will ſoon flame, and a thick ſmoak accompanied with the flowers will ariſe and adhere to the upper part of the crucible: when the zinc ceaſes to flame, ſtir it with an iron rod or ſpatula; and continue this operation till the whole is ſublimed and converted into flowers, and the zinc ceaſes to flame; then take the calx or flowers out of the crucible, put in freſh zinc, and repeat the operation according to the quantity of flowers you wiſh to prepare.

The flowers of zinc thus formed, are the zinc reduced to a ſort of calx by being deprived of a large portion of its phlogiſton, but not of the whole; for acids act upon the flowers equally almoſt as upon the zinc itſelf, which Monſ. Morveau thinks is a ſure ſign of their ſtill retaining a quantity of phlogiſton. The zinc, by being thus converted into a calx, becomes one of the moſt fixed ſubſtances known, and bears the action of the ſtrongeſt fire without ſubliming, and is reduced to a ſort of glaſs; but it cannot (Mr. Macquer ſays) be brought back to the ſtate of a metal by the addition of fluxes as other metals are.

Theſe flowers have of late years been re-

recommended as an efficacious remedy for curing the epilepſy, and other ſpaſmodic diſorders, given from one to ſeven or eight grains or more for a doſe; and hiſtories of caſes are related, which are ſaid to have been cured by their means. I have ſeen them often given in ſuch caſes, and the doſe increaſed to twenty, nay to thirty grains; but I have hitherto been ſo unlucky as not to have ſeen one cure effected by their means.

Mr. Geoffroy ſays that theſe flowers are ſudorific, and that they ſometimes both vomit and purge, when taken from four to twelve grains for a doſe.

Finely levigated and reduced to the ſtate of an impalpable powder and mixed with oily ſubſtances, they form uſeful ointments and cerates, preferable to thoſe prepared with lapis calaminaris; and with roſe water, make a good waſh for the eyes.

The ſubſtance formerly called *pomphylix*, found in the furnaces where copper is made into braſs, has been diſcovered to be pure flowers of zinc.

SECT. IX.

White Vitriol.

VITRIOLUM Album, white vitriol. If zinc be diſſolved in three times its own weight of the vitriolic acid, and as much diſtilled water, by digeſting it in a matraſs, and then the liquor be evaporated properly and ſet in a cool place for a night, it ſhoots into cryſtals, which are called *white vitriol.*

The white vitriol is a ſtrong aſtringent, and been formerly more uſed as an external than an internal remedy. It operates quickly and mildly as an emetic, when taken from ten to twenty or thirty grains; and thought to be preferable to other vomits in the nervous aſthma, as it operates very quickly. It is an extremely uſeful remedy where people have ſwallowed, by miſtake, poiſonous or unwholeſome things, which we wiſh to be diſcharged from the ſtomach ſoon. Of late years it has been adminiſtered in ſmall doſes of one, two, or three grains, as an antiſpaſmodic medicine in the chincough, and in other convulſive diſorders, and is ſaid to have produced good effects. It has long been uſed as an aſtringent ingredient in collyria for waſhing the eyes, and in injections for ſtopping gleets.

The native white vitriol found in the mines at Goſlar and elſewhere, has commonly an admixture of more or leſs iron; and likewiſe gives marks of its containing copper; hence the white vitriol was at one time ſuppoſed to be only the green vitriol calcined to whiteneſs, and at another to be a compound ſubſtance: but later experience has ſhewn that the pure white vitriol is a metallic ſalt formed of the zinc and the vitriolic acid; and that when it gives marks of its containing iron or copper, it is a ſure ſign that it is not perfectly pure, but that it is adulterated with foreign mixture.

SECT. X.

Biſmuth.

BISMUTHUM, marcaſita, called in Engliſh biſmuth, tin-glaſs, or marcaſite, is a hard, brittle, ſhining ſemimetal, compoſed as it were of thin lamellæ made up into little ſquares, of a yellowiſh white colour. It melts with a leſs heat than tin itſelf, eaſily mixes with metals, whitens them, and deſtroys their ductility. When expoſed to a ſtrong heat it emits copious fumes, and loſes much in the fire, yea may be all driven off in vapour.

It does not ſeem to be certainly determined where or how the biſmuth is got, ſome alleging that it is found in ſilver or tin mines in England; others that it is brought from Miſnia; others from Germany, and ſo forth.

It diſſolves in the vitriolic acid; and Monſ. Morveau ſays, that a cryſtallized vitriol of biſmuth may be obtained from this ſolution by evaporation; but the cryſtals, on being dried and expoſed to the air, fall down into a white earth. It diſſolves very readily in the nitrous acid, but with difficulty in the pure muriatic, though it diſſolves eaſily in aqua regia. It is not acted upon by the acetous acid.

It is generally ſuppoſed (though perhaps without ſufficient reaſon) to contain arſenic; and therefore to be neither ſafe for internal nor external uſe; and therefore is now never uſed as a medicine, and has been thrown out of moſt diſpenſatories.

A white precipitate, obtained by throwing water impregnated with ſea ſalt into its ſolution in the nitrous acid, and then well waſhed in diſtilled water, has been called the magiſtery of zinc; and been uſed by the women as a coſmetic to whiten the face, when mixed with pomatum, or diluted with water of lilies: but as it is a ſtrong aſtringent, it is apt in time to make the face full of pimples, and even to endanger the conſtitution.

SECT. XI.

Arſenic.

ARSENICUM, arſenic, is contained in greater or in leſs quantity in moſt kind of ores; but the greateſt quantity of what is brought to market is extracted from cobalt, which is reckoned its proper ore.

There are commonly reckoned to be three ſorts of it: 1. The white; 2. The yellow; 3. And the red. The *white* is the pure arſenic in a cryſtalline form. The *yellow* is the white ſublimed with one-tenth part of ſulphur. And the *red* is the white united with ſtill a greater quantity of ſulphur.

The arſenic was formerly conſidered as a ſulphureous ſubſtance; but it is now ranked among the metallic; and its reguline part is moſtly made up of a particular ſort of acid, endowed with properties peculiar to itſelf.

It is amongſt the moſt virulent and ſtrongeſt native poiſons, and is deſtructive to every animal. It has a particular taſte, and if ſwallowed it corrodes the ſtomach, occaſions a ſwelling, and ſphacelation of the whole body, and a ſudden putrefaction after death.

Notwithſtanding its virulence, there have been people bold enough to uſe it in ſubſtance, both as an internal and an external remedy. It is ſaid to be uſed by ſome foreign practitioners as a cure for the ague, given in doſes from a quarter to half a grain; but the late Dr. Duval, who was phyſician to her Royal Highneſs the late Princeſs of Wales, told me, that he had once been deſired to ſee it adminiſtered as a cure for the ague, by a bold quack; that three people had taken it in doſes of a quarter of a grain; that one of them died of the effects of the arſenic; one was taken very ill, but did not die; and that the third recovered without any ſymptoms of bad effects produced by arſenic.

A Monſ. le Febure has recommended a weak ſolution of arſenic, mixed with equal parts of milk and with ſome ſyrup of poppies, to be taken for the cure of cancers. He ſays it is a ſafe medicine if taken with the cautions he directs, and alleges that he has made cures by its means; but notwithſtanding his aſſurances, I cannot help looking upon it as a dangerous remedy, even when adminiſtered with every caution poſſible.

About thirty years ago an itinerant quack uſed to ſell in Lincolnſhire a medicine, the receipt of which he kept a profound ſecret, which he ſaid was an infallible cure for an ague. After his death his widow, whom he had left in great diſtreſs, ſold the receipt to ſome of the practitioners in the neighbourhood for a ſmall ſum of money, and one of them gave me a copy of the receipt above twenty years ago, and told me that he had ſeen it have a good effect in ſome few caſes, which had not yielded to the bark. The receipt was as follows:

Take an ounce of white arſenic finely powdered, two ounces of potaſhes (fixt vegetable alkali), an ounce of red Sanders wood, cut and bruiſed; mix them all together, and boil them from twelve pints of pure water to four; and when the liquor is cool, filter it through paper. The doſe of this medicine to people labouring under intermittents, to be given once in nine hours, as follows:

To a perſon from fourteen to thirty years of age, ſeven drops, in two ounces of tea or of barley water; from ſeven to fourteen years of age, five drops; from three to ſeven years of age, three drops.

I have ſeen it given in three or four caſes of obſtinate agues; it did not produce any viſible effects, nor did it ſtop the aguiſh fits.

By the experiments and obſervations made by Monſ. Macquer and Monſ. Morveau, it ſhould appear, that the tincture juſt mentioned is a ſolution of a neutralized liver of arſenic, and not of the true neutral ſalt of that mineral; which, from the addition of phlogiſton, they ſay, has properties different from thoſe of the ſolution of the true neutral ſalt.

Mr. Morveau ſays, that the true neutral ſalt cannot be obtained from arſenic till it be deprived of its phlogiſton; and that the only method hitherto known of obtaining it, is the following: Mix equal quantities of nitre and of pure white arſenic well together, put them into a retort, and diſtil, firſt with a gentle heat, and afterwards with ſuch a ſtrong heat as to redden the bottom of the retort; by which means the nitrous acid united to the phlogiſton of the arſenic will riſe into the receiver, and the alkaline baſis of the nitre will unite with the acid of the arſenic, and will be found in the bottom of the retort in form of a neutral ſalt, which may be obtained in form of cryſtals of a priſmatic ſquariſh figure, by diſſolving the neutral in diſtilled water, filtering the ſolution through paper, and evaporating and cryſtallizing. In diſtilling the arſenic with nitre it ought to be obſerved, that as the nitrous acid united to the phlogiſton riſes in a very volatile ſtate, and is in danger of burſting the veſſels, if great care is not taken to prevent it, an adopter ought to be put between the retort and receiver, and the receiver uſed ought to be large and tubulated; and the veſſels, Monſ. Morveau ſays, ought only to be ſlightly luted together. As it was ſuggeſted that the neutralizing the arſenic might render it mild and deſtroy its deleterious effects, Monſ. Morveau tried what effect this neutral ſalt would have on a dog: he gave him a dram (un gros) of this neutral ſalt, which acted rather like a ſlow than corroſive poiſon; he languiſhed for a month, fell away amazingly, would take no nouriſhment, and at laſt died. On opening his body, the ſtomach did not appear to be corroded.

Monſ. Morveau mentions likewiſe, that Mr. Macquer had obſerved that thoſe people who had been cured of intermittents by taking ſmall doſes of arſenic, were liable to become phthiſical.

Arſenic has been employed as an external, as well as an internal remedy for removing cancers.

Above forty years ago a man of the name of Plumked, in Ireland, pretended to have a remedy which was an infallible cure for a cancer. A baronet, Sir F. K. poſſeſſed of a good fortune in the county of Eaſt Lothian, in Scotland, hearing of this, ſent for him, in order to cure a cancer he had on his face. His remedy was a powder, which he applied to the cancerous part; but the application of it in this caſe, inſtead of curing the cancer, gave immenſe pain, and made the ſore ſpread much faſter than it had done before, and brought on other troubleſome ſymptoms, which made the baronet ſoon lay aſide the uſe of this remedy; and Plumked went away leaving his patient in a much worſe ſituation than he had found him. Having left behind him a parcel of his powders, the patient gave them to the phyſical people who uſually had attended him, among whom was my father: they, from the effects the powders had produced, ſuſpecting that they contained arſenic, put ſome of them on an ignited poker, and they immediately occaſioned a ſtrong ſmell of garlic; and on putting ſome of the powder between two clean halfpence, and holding them in the fire with a pair of tongs, the halfpence acquired a white colour; and laſtly, by ſhaking a quantity of the powder on a ſheet of white paper, they ſeparated from it as much pure white arſenic as covered a ſhilling. Since then the following receipt, ſaid to be given by Plumked himſelf to St. Stephen's hoſpital, Dublin, was publiſhed in a book entitled, *Theory and Practice of Chirurgical Pharmacy*, p. 237: Take the following ingredients well powdered, and incorporate them together in a mortar: of crow's foot one handful; of dog's fennel three ſprigs; of crude brimſtone, and of white *arſenic*, of each three middling thimbles full: mix this powder with the yolk of an egg and apply it to the ſore. Since that time a ſurgeon of the name of G— uſed this powder in a great number of cancerous caſes, here in London; but I never heard of a true cancer being cured by this remedy. It removed ſome tumours that were ſuſpected to have been ſcrophulous or ſteatomatous, which did not return

turn again; but the true cancerous tumours returned in the ſame manner as thoſe which are taken away with the knife; and the powder gave much more pain and uneaſineſs than the knife, and its operation was often protracted for many days: it irritated ſome cancerous ſores greatly, and was thought to have haſtened their progreſs very much.

From any thing I have either heard or ſeen of the effects of arſenic, I think that we have no great encouragement to perſiſt in the uſe of ſo dangerous a remedy.

SECT. XII.

Lapis Hæmatitis.

LAPIS *Hæmatitis*, bloodſtone, is a kind of ore of iron, which does not differ much in its virtues from the ruſt, and other crocuſes of that metal, notwithſtanding what authors have ſaid in its favour. At preſent it is not uſed.

CHAP.

CHAP. IX.

Of Earths.

HAVING taken a view of ſalts and metallic ſubſtances, and their preparations, I come next to conſider earths; which, from their different properties, have been divided into three claſſes. 1. The abſorbent. 2. The argillaceous. 3. And the cryſtalline.

SECT. I.

Abſorbent and calcarious Earths.

THESE earths have got their name from abſorbing and uniting with acids; by which union the acids loſe entirely their properties, and are converted into a ſort of neutral ſubſtance; on which account they were introduced into practice by Tachenius, Sylvius, and others, who believed that all diſeaſes took their riſe from an acid.

The number of theſe earths, which were uſed about a hundred years ago, was very great; but as many of them have been found to be poſſeſſed of no medicinal virtues, and many of the others to be nearly of the ſame nature; I ſhall only conſider a few, which may ſupply the place of all the others, for any medicinal purpoſes they may be wanted: ſome of which belong to the *mineral* kingdom, others to the *animal*; but none to the *vegetable*, unleſs the coral be a true marine plant, which is much doubted by many.

Thoſe which I ſhall treat of at preſent are:

1. Chalk—Creta.
2. Magneſia—Magneſia
3. Coral—Corallium.
4. Crabs-claws—Cheli cancrorum.
5. Calcined hartſhorn—Corn. cervi calcinat.
6. Egg-ſhells—Teſtæ ovorum.
7. Oyſter-ſhells—Teſtæ oſtreorum.
8. Limeſtone—Lapis calcarius.

In treating of which, I ſhall firſt conſider the firſt ſeven; and then the limeſtone ſeparately, and its properties when changed into quicklime by the force of fire.

Theſe abſorbent earths are ſoluble in acids; and each of them forms a different ſort of neutral earthy ſalt with each of the different acids.

The vitriolic acid forms with the *magneſia* the magneſia vitriolata, commonly called Epſom ſalt, which is the only one of the neutral ſalts formed with theſe earths and acids that is uſed in this country. With calcarious earths it forms *ſelenites*, *gypſum*, and *talc*, which require ſuch a quantity of water to diſſolve them, as to be quite inſoluble in the ſtomach and bowels of animals.

The nitrous acid entirely diſſolves theſe earths; and their ſolutions evaporated and cryſtallized form cryſtals that ſoon run per deliquium, when expoſed to the air; and if they be calcined with a moderate degree of heat, they are converted into a kind of phoſphorus. None of theſe ſalts are uſed as medicines.

The muriatic acid diſſolves theſe earths likewiſe; and forms ſalts of a very deliqueſcent nature, which are never uſed in practice: a ſalt of this kind, formed with magneſia, is one of the ſalts got by evaporating ſea-water.

The vegetable acids diſſolve theſe earths very readily; and the French uſe ſeveral of theſe earthy ſalts, thus formed, as medicines, though they have not been introduced into practice in this country.

Theſe earths, before they are adminiſtered as medicines, ought always to be reduced to the ſtate of a fine impalpable powder, according to the directions given in the pharmacopoeia ſubjoined to this work.

1. *White Chalk.*

CRETA ſubrupeſtris alba—Lin. Syſt. Nat. This chalk is found plentifully in Kent, and in many of the other ſouthern counties of England, and in France, Germany, and in other countries. It is an abſorbent earth, entirely ſoluble in vinegar, and the other vegetable acids; and it may be reduced to the ſtate of lime by the force of fire. At preſent it is much employed in practice as an abſorbent earth.

2. *Magneſia.*

MAGNESIA is leſs common than other primitive earths; or to ſpeak more properly, it is ſo mixed with other matters, that it can neither be immediately diſtinguiſhed, nor often freed from heterogeneous matters, without the help of acid menſtrua. Hitherto no ſtrata, or parcels of pure magneſia have been diſcovered either on the ſurface or in the bowels of the earth; but it has been always found mixed with other earths, or other heterogeneous ſubſtances, or combined in form of a ſalt with ſome of the mineral acids. It is the baſis of the Epſom ſalt (magneſia vitriolata), which is prepared from purging mineral waters, and from ſea-water in large quantities: and the greater quantity of magneſia, if not the whole that is now uſed, is got by diſſolving a large quantity of the magneſia vitriolata in four times its own weight of boiling diſtilled water; and then adding to it a ſufficient quantity of the pure fixt vegetable alkali, diſſolved likewiſe in four times its own weight of diſtilled water; which, having a greater affinity with the vitriolic acid than the magneſia, unites with it; and the magneſia precipitates in form of a white earth; and is got by ſtraining the liquor through a cloth of a cloſe texture; after which it is waſhed in warm diſtilled water till it is perfectly inſipid; and it is then dried and kept for uſe.

In performing this proceſs, artiſts commonly add a quantity of pure fixed vegetable alkali, equal to that of the Epſom ſalt uſed, to make ſure of having a ſufficient quantity of alkali to precipitate the magneſia: and they employ a large quantity of water, commonly diſſolving both the Epſom ſalt and the alkaline ſalt in three or four times their own weight of water; and adding twelve or more times the weight of both the ſalts, after they are mixed; during the time of mixing the ſolutions of the ſalts, they keep ſtirring about the water with a wooden ſpatula, and continue ſo doing for ten or twelve minutes, that the liquor is kept on the fire afterwards.

The magneſia thus procured, is ſoluble in all the acids; and it has the peculiar property of giving a bitter taſte to all the neutral ſalts formed with it and acids. That formed with the vitriolic acid, formerly called Epſom ſalt, and ſal catharticus amarus, and now magneſia vitriolata, is the only one which is uſed in practice, and is the one I already mentioned when I conſidered the true neutral purging ſalts.

The magneſia has a laxative quality; and, on this account, is preferred to the other abſorbent earths on many occaſions; as it is not apt to lodge in the bowels of children, and occaſion coſtiveneſs, which the others ſometimes do. Like other abſorbents, it is given to correct acidities in the ſtomach and bowels of children and of adults; and it is very common to add ſome powder of rhubarb or of jalap to it, when we wiſh that it ſhould operate by ſtool. It is often given for the heartburn, and for other complaints which are thought to proceed from an acid.

The doſe of magneſia is from ten grains to two drams, or more. The common magneſia contains a great quantity of air, which ſometimes diſengages itſelf in the ſtomach, and occaſions conſiderable inconvenience; to remedy which, it is often ordered to be calcined to free it of its air, which reduces it to half its bulk; the air diſcharged being according to Dr. Black's experiments above half its weight.

The calcined magneſia is equally mild with the aerated, not being converted into quicklime by this operation; and it has double the ſtrength as an abſorbent and as a laxative; and it unites with acids without raiſing any efferveſcence in the ſtomach; and, therefore, is preferable to the *aerated* on many occaſions.

3. *Coral.*

CORALLIUM album et rubrum, white and red coral. Theſe are branched ſtrong ſubſtances, reſembling ſhrubs or branches of trees without leaves; which are found growing in the ſea, and ſometimes on the ſhells of fiſhes; particularly in the Mediterranean Sea, from whence the greater part of what is uſed is brought to this country. They were formerly believed to be marine plants; but they are now generally thought to be the productions of certain marine inſects, which are a ſpecies of polypi: they are merely abſorbents; and the red has been kept in many diſpenſatories, principally on account of its colour.

4. *Crabs-*

4. *Crabs-Claws.*

CHELI cancrorum. The black tips of the claws of the common ſea-crab, after being broke and well waſhed in boiling water, and reduced to a fine powder, are amongſt the abſorbent powders uſed in moſt diſpenſatories. Dr. Lewis obſerves, that this powder, as well as others prepared from animal ſubſtances, contains a glutinous matter beſides the earth, which, he thinks, gives them a tendency to concrete in the ſtomach and bowels; and therefore he prefers the abſorbent powders of the mineral kingdom to them; but accidents of this kind occur but very ſeldom now, becauſe the abſorbent powders are not given in that free manner as they were formerly; and becauſe practitioners take care to keep the body open during their uſe; generally adding rhubarb or ſome other purgative medicine, if the body is inclined to be coſtive.

5. *Burnt Hartſhorn.*

CORNU cervi calcinatum. This is another abſorbent earth of the animal kind, which contains much leſs mucilaginous matter than any other of them, on account of its being burnt. It is very much given in diarrhœas and dyſenteries in the decoctum album; and I have often ſeen it prove a very uſeful remedy in ſuch caſes. In ſome caſes it has an advantage over many of the other abſorbent earths; for if patients are taking medicines which contain the vitriolic acid at the ſame time with it, the vitriolic acid forms with it a mild neutral ſalt, which is ſoluble in water; but with chalk and oyſter-ſhells it forms a ſelenites, which is inſoluble by the juices of the ſtomach and inteſtines.

6. *Egg-Shells.*

TESTÆ ovorum form an abſorbent powder nearly of the nature of the crab's claws.

7. *Oyſter-Shells.*

TESTÆ oſtreorum. The oyſter-ſhells properly prepared, have been much uſed as an abſorbent powder. They are often ordered to be calcined into lime, to make lime-water with: the lime-water made with them being leſs harſh, and thought to be equally efficacious as that made from common quicklime.

The principal uſes of theſe abſorbent earths are to ſuck up moiſture, and to deſtroy the effects of acids in the firſt paſſages; for they have no ſuch aſtringent quality as is generally attributed to them.

They are preſcribed ſometimes with advantage, for weak people who are troubled with inflations of the ſtomach and inteſtines, or with ſour belchings, or with other ſymptoms of an acid crudity. They often remove the heartburn, which commonly proceeds from an acid in the ſtomach: they remove gripes and other complaints of the bowels of children, which ariſe from acid crudities contained within them; and are particularly uſeful to thoſe who are troubled with ſour belchings, and who paſs green ſmelling ſtools.

However it ought to be obſerved, that the too free uſe of ſuch powders has ſometimes done miſchief, by coagulating with the mucus of the alimentary canal;

into hard indigeſtible maſſes, which have remained in theſe paſſages, and brought on ſickneſs, nauſea, and gripes, and other troubleſome ſymptoms; and we are told by Dr. Albert, in his Diſſertatio de Atrophia, that the whole alimentary canal has been found ſo covered with a cruſt formed of theſe ſubſtances, as to block up the mouths of the lacteals, and occaſioned an atrophy, which deſtroyed the patient; to prevent which accidents, rhubarb or other purgatives are often mixed with the abſorbent powders, or given at proper intervals during their uſe.

In many caſes it has been found of advantage to mix bitter or aromatic medicines, ſuch as contrayerva, zedoar, ginger, cinnamon, or other ſuch ſubſtances with them, in order to give a ſtimulus to the nerves and to aſſiſt digeſtion.

From experiments made with chalk and teſtaceous powders, it has been found that they promoted and increaſed the putrefaction of dead animal ſubſtances; and from thence it has been concluded, that they were not fit medicines to be given in putrid diſeaſes; but I have given them to many hundreds of people labouring under fevers and fluxes, and I never obſerved that they produced any bad effects; on the contrary, I have often ſeen them adminiſtered with the greateſt advantage in caſes where abſorbents ſeemed to be indicated.

8. *Of Limeſtone or calcarious Earth.*

EARTHS which change into calces or quicklime by the force of fire, and from being mild and inſoluble in water, become fiery, cauſtic, and ſoluble in water, have been called *calcarious*, to diſtinguiſh them from the earths of other claſſes.

Of theſe we have three in our Diſpenſatory, which are employed in medicine, and often converted into lime, viz. 1. *Chalk.*—2. *Oyſter-ſhells.*—3. And *limeſtone.* The *chalk* and *oyſter-ſhells* I have already taken notice of among the abſorbent earths; and the *limeſtone* is never uſed in practice till it is calcined and reduced by the force of fire to the ſtate of quicklime; when it is employed for making lime-water, for diſſolving reſinous or oily bodies, or for extracting them from other ſubſtances; for rendering alkaline ſalts cauſtic; and for making ſoap ley and common cauſtic.

Till the year 1756, it was believed that the change which calcarious earths underwent, by being calcined, was owing to ſomething they got from the fire in the time of their calcination; but Dr. *Black*, in a paper which he publiſhed in the ſecond volume of the Edinburgh Phyſical and Literay Eſſays, has demonſtrated, that all the change they undergo, is the being deprived of fixed air (aerial acid), with which they abound: and that ſo ſoon as the quicklime is ſaturated again with this air (or acid), that it again returns to the ſtate of a mild calcarious earth, inſoluble as before in water. This he has proved by a number of experiments.

1. He mixed acids with common calcarious earth, and immediately a ſtrong efferveſcence enſued, owing to theſe acids having a greater affinity with the calcari-

ous earth, and diſlodging the fixed air or aerial acid; and as a proof of this being the caſe, he found that on mixing the ſame acids with the calcarious earth after it was reduced to the ſtate of quicklime, that no effervеſcence followed, though they formed the ſame ſort of neutral earthy ſalts as before; and upon trying the like experiments with mild and cauſtic alkaline ſalts, he found the ſame thing happen.

2. He ſaturated in different ways the calcarious earth, reduced to the ſtate of quicklime, with air; and it immediately returned to its former ſtate of a mild inſoluble calcarious earth. He mixed quicklime with the common or mild volatile alkali, and diſtilled with a retort and receiver; and the volatile alkali came over into the receiver in a cauſtic ſtate, and the quicklime reduced to the ſtate of a mild calcarious earth, remained behind in the retort: in this proceſs the air which has a greater affinity to the quicklime than to the volatile alkali, united itſelf to it, and remained behind in the retort;

while the volatile alkali, deprived of its air, roſe in a cauſtic ſtate, and would not effervefce with acids. He ſpread quicklime thin on a broad expanded ſurface, and it ſoon attracted a ſufficient quantity of air, or aerial acid, to reduce it back to its former ſtate of a calcarious earth.—He expoſed lime-water, which is a ſolution of quicklime in water, to the air, in a wide open-mouthed veſſel, and it very ſoon attracted a quantity of air ſufficient to reduce it to its former mild inſoluble ſtate: this change happened at the ſurface, where it collected in form of a cruſt or cream; and when this cruſt was removed, a freſh one ſoon formed, and by removing theſe cruſts ſucceſſively as they formed, he got the whole quantity of quicklime, which had been diſſolved in the water, reduced back to the ſtate of a calcarious earth, capable of being again deprived of air, and being brought again to the ſtate of quicklime.

By theſe and a great many other curious experiments, Dr. Black has demonſtrated, beyond all doubt, that quicklime

lime is only a calcarious abſorbent earth, diſunited from fixt air or aerial acid, with which it is ſaturated in its natural ſtate—that quicklime is almoſt entirely ſoluble in water—that a ſmall quantity of it ſaturates a great quantity of water—that the cruſts thrown up by the lime-water are only the lime reduced again to the ſtate of a calcarious earth.

Hence we may account why a pound of quicklime ſaturates a quart of water ſo many repeated times; and why lime-water becomes weaker the more cruſts it throws up.

In making theſe experiments, Dr. Black found, that quicklime had a greater affinity with fixt air than either the fixt or volatile alkaline ſalts, which accounts for the common alkaline ſalts precipitating quicklime from water.

Limeſtone or calcarious earth is acted upon by all the acids.

1. With the *vitriolic* it forms ſelenite, which is a neutral earthy ſalt which requires at leaſt 500 times its own weight of water to diſſolve it.

2. With the *nitrous* it forms a calcarious nitre, which has a ſharp nitrous taſte, and runs per deliquium in the air: it has never been uſed as a medicine; and if calcined, it forms a kind of phoſphorus.

3. With the muriatic acid it forms a deliqueſcent ſalt, which in its dry ſtate has been called fixt ammoniac, but when allowed to run per deliquium, has got the name of liquid ſhell, and been recommended as a powerful diuretic and lithontriptic, though I do not know that experience has proved it to be ſo.

4. With *vinegar* it forms a ſalt which is very bitter, and taſtes of vinegar; it does not run per deliquium, but becomes flowery when expoſed to the air. If this ſalt be diſſolved in water and its earthy baſis precipitated by means of an alkaline ſalt, it is found to be a very fine divided earth, which has been called a magiſtery: and if this ſalt be expoſed to ſuch a degree of heat as to ſeparate its acid, it riſes in form of fine white vapours, which are very inflammable, and, Monſieur Morveau ſays, ſmell of the vegetable æther.

5. With fixt air or *aerial acid*, as it is now called, it forms common mild calcarious earth.

Quicklime diſſolves animal and vegetable ſubſtances in the ſame manner as the cauſtic alkali ; and it acts in like manner in diſſolving ſulphur.

The late Dr. Macbride, of Dublin, mentions in his Experimental Eſſays, that it diſſolves reſins ; and if ſubſtances which contain a reſin be rubbed with quicklime, and be afterwards infuſed in lime-water, that they yield their reſinous parts to it, which paſs through the filter with it, and form a clear and tranſparent tincture ; and he propoſes to make watery tinctures from *aloes*, *balſam of Tolu*, *camphor*, *caſtor*, *gum guaiacum*, *jalap*, *maſtich*, *Peruvian bark*, and other ſubſtances which contain a reſin ; and he thinks that theſe aqueous tinctures are more elegant, and perhaps may prove more efficacious, than the ſpirituous ones, on account of the extremely minute diviſion of their moſt active part ; and that they will not become turbid and be decompoſed by the watery liquors they meet with in the ſtomach, as the ſpirituous tinctures which contain nearly the ſame principles are; and beſides they may be taken in larger doſes, and with greater freedom, the menſtruum being water and not ſpirit.

Lime-water poſſeſſes the ſame properties, but in a ſmaller degree, and may be uſed on many occaſions for the ſame purpoſes.

I have not tried any of the tinctures here propoſed, except that of the Peruvian bark, which is ordered to be made in the following manner:

Take of Peruvian bark in powder two ounces, of quicklime one ounce, rub them well together, and then infuſe them in thirty ounces of lime-water, and let them ſtand for twelve hours, and then filter the liquor through paper.

Of this tincture I have ordered from one to two or three ounces to be taken every four or ſix hours in intermitting caſes, in the fluor albus, and in ſcrophulous caſes with good effect.

Dr. Macbride propoſes that the camphor and muſk juleps ſhould be made by rubbing theſe ſubſtances with ſugar, and then uſing lime-water in place of common water, as it diſſolves them in greater quantity, and keeps them ſuſpended.

He ſays, in like manner may ſcammony or reſin of jalap be diſſolved; and if ſome grains of Jamaica pepper be added and rubbed along with the ſugar and other ingredients, that they will communicate a moſt agreeable cinnamon flavour, which entirely covers the taſte of the jalap, or ſcammony. Theſe ſolutions, he ſays, make very elegant and pleaſant purging draughts, only it muſt be remembered to order near triple the quantity of either the reſin or ſcammony that would anſwer if given in ſubſtance; for the reſinous particles are ſo minutely divided in this ſort of ſolution, that they give but a very gentle degree of irritation to the bowels.

Quicklime is too cauſtic to be given in ſubſtance as a medicine: it is only uſed in this form for preparing the ſoap ley and common cauſtic; and for rendering alkaline ſalts cauſtic.

Lime-water, however, has been employed for many purpoſes; it is aſtringent, antacid, and ſaid to be antiſeptic. It is a powerful ſolvent of viſcid mucus, and of viſcid mucilaginous concretions; and therefore has been often given when the ſtomach and bowels were weak and loaded with ſuch humours; particularly when it was joined to bitters or aromatics. It has been found to act upon the calculi generated in the human bladder, and to aſſiſt in diſſolving them; and the late Dr. Whytt, of Edinburgh, wrote a treatiſe on this ſubject, in which he relates caſes where people labouring under the ſtone were greatly relieved by the continued uſe of this remedy; and mentions one or two caſes where complete cures were thought to have been made by the patients drinking from one to three pints daily for a length of time; and at the ſame time uſed ſoap, and occaſionally took of the ſoap ley. I have ſeen many people who had the gravel relieved by theſe means; but never ſaw any permanent ſervice done to thoſe who laboured under the confirmed ſtone. It has been given as an aſtringent where there was too great a laxity of the inteſtines, after diarrhœas and dyſenteries had continued for ſome time; and has often been of ſervice in putting a ſtop to the fluor albus, and to gleets; and in deterging and healing old ſores. It has been given with advantage in many cutaneous diſorders, eſpecially when ſaſſafras, ſarſaparilla, guaiac wood, and other ingredients were joined to it, as they were in the aquæ calcis compoſitæ of former diſpenſatories. It has been found of uſe in correcting the bad habit of people labouring under the dregs of the ſcurvy, and in ſcrophulous caſes; and it has been recommended for the cure of many other diſorders, as an aſtringent, ſtrengthening and deobſtruent medicine.

Lime-water externally applied is a drying and healing remedy; and I know no better application to a recent burnt part, than a mixture of three ounces of lime-water with one of linſeed oil.

SECT. II.

Argillaceous Earth.

THE argillaceous is a particular ſort of earth, different from all others, which conſtitutes a principal part of all clays; it is never almoſt found pure, but mixed with other earths.

It is this earth which forms the baſis of alum; and the moſt ready way of obtaining it pure, is by diſſolving alum in diſtilled water, and precipitating its earth by the addition of a ſolution of the fixt vegetable alkali in water. By Sir Torbern Bergman's account, a hundred ounces of alum contain eighteen ounces of pure argillaceous earth, thirty-eight ounces of vitriolic acid, and forty-four ounces of water.

The argillaceous earth does not calcine or vitrify by the mere force of fire, though it may be united to other earths, by the mixture of other ſubſtances.

It is generally found in a friable ſtate, and abſorbs a great quantity of water, and ſwells with it; and it likewiſe abſorbs oil, on which depends the property of Fuller's earth taking out oil or other greaſe from clothes.

There is a great variety of earths that are called argillaceous, but however different they may appear, the pure earth is the ſame in all, when freed of heterogeneous mixture.

They are ſold of different colours, which they owe to foreign mixture; the white is the pureſt.

In the former edition of the London Diſpenſatory there were three different ſorts of theſe earths, two under the name of boles, and one of earth; the *bolus Armenia*, the *bolus Gallica*, and the *terra Lemnia.* As the earth of alum is the pureſt, and we can always be ſure of having it genuine, it ought to be adopted into the diſpenſatory, to ſupply the place of all the others.

Boles mix eaſily with water, and are ſuſpended but not diſſolved in it; and the turbid ſolutions appear ſmooth and ſlippery to the touch, and are of a ſaponaceous nature: the three which were in the laſt diſpenſatory contained a ſmall portion of iron, as well as a ſmall quantity of the vitriolic acid, which gave them a red colour, and likewiſe a degree of aſtringency.

Argillaceous earth, with the *vitriolic acid*, forms alum—with the *nitrous*, a ſalt which is more ſtyptic than the common alum—with the *muriatic*, a muriatic alum. *Vinegar* does not immediately act upon it, but by long digeſtion in a ſand heat diſſolves a ſmall quantity, and from this ſolution cryſtals of the form of needles may be obtained.

Theſe argillaceous earths, or boles, have been moſtly uſed as abſorbents and gentle aſtringents in diarrhœas and dyſenteries; formerly many virtues were attributed to them, which have not been confirmed by experience.

Alum.

ALUMEN. Alum is the only ſalt made with argillaceous earth, and any of the acids which have been uſed as a medicine.

Its cryſtals are ſemi-tranſparent, of a white colour, with a reddiſh caſt, of an octagonal figure, and ſoluble in water. They have a ſtrong aſtringent ſtyptic taſte, with a kind of ſweetiſhneſs. If melted they bubble, and turn into a light ſpungy ſubſtance, called burnt alum; which is more or leſs acrid according as it has been more or leſs expoſed to the force of the fire.

Alum is a ſtrong aſtringent, coagulates milk, and moſt of the animal juices, and changes the blue colour of vegetables into a red colour, which ſhews the acid to be prevalent in it.

It is given moſtly as an aſtringent, and to allay the too great irritability of the fibres. It has been employed to ſtop violent hæmorrhagies, eſpecially from the uterus, when joined with that reſinous ſubſtance called dragon's blood. Dr. Thomſon of Montroſe, in the Edinburgh Medical Eſſays ſays, that he ſeldom failed to ſtop floodings after child-birth, and too profuſe diſcharges of the menſes, by theſe medicines; and Dr. Mead has recommended the ſame powder for the ſame uſes. Alum ſhould ſeem to act in ſtopping hæmorrhagies, not only as an aſtringent, but likewiſe by allaying the heat, rarefaction and violent fermentation of the blood, and the too great irritability of the fibres. It has been employed ſometimes with ſucceſs in ſtopping gleets, and the fluor albus. Dr. J. Adair, of Bath, who formerly practiſed phyſic at Antigua, mentions in the ninth and tenth volumes of the Edinburgh Medical Commentaries, publiſhed in the years 1785 and 1786, that alum given from ten grains to half a dram, is a ſafe aſtringent medicine, particularly when its ungrateful ſtimulus in the ſtomach is covered with gum arabic, ſpermaceti, or with opium; that he uſed it with advantage in a late epidemic dyſentery, likewiſe in ſome febrile diarrhœas, and in the diarrhœa cachectica, which carried off many negroes laſt autumn. In intermittents from five to ſeven grains of alum mixed with as much canella alba, and a dram of Peruvian bark, given three, four, or five times in the day, removed the fever, and prevented a relapſe.

The doſe of alum in ſubſtance is from five to twenty grains. In general it is better to give it in ſmall but often repeated doſes, than in large ones at once; and we ought to be cautious and not continue the uſe of this medicine too long, for it has ſometimes brought on a conſtriction of the inteſtines, and a troubleſome coſtiveneſs which it has been difficult to remove.

There is but one preparation of it in our diſpenſatory intended to be uſed as a medicine, which is the *ſerum aluminoſum*, which is a whey prepared by mixing two drams of alum with a pint of milk. It has been employed for the ſame purpoſes as the alum itſelf.

Alum has been uſed as an external remedy for ſtopping hæmorrhagies, for mixing with gargles and collyria, and for cleanſing the teeth; and ſolutions of it have been employed for bathing weak, relaxed parts, and for deſtroying proud fleſh, and healing ulcers. The white of an egg beat up with a fine powder of alum until it formed a coagulum, has been uſed as an external application under the name of *coagulum aluminoſum*; and the *burnt alum* has been employed as a gentle eſcharotic, for eating down proud fleſh from ſores and ulcers.

SECT. III.

Cryſtalline Earths.

THE cryſtalline earths, flint, ſand, cryſtal, &c. are now univerſally rejected as medicine, being quite inſoluble by our juices. They ſtrike fire with ſteel, and they run into glaſs with alkaline ſalts.

END OF THE FIRST VOLUME.